

SMOLT MONITORING PROGRAM

ANNUAL REPORT 1986

Volume I

Migrational Characteristics of Columbia Basin
Salmon and Steelhead Trout, 1986

by

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for

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Agencies and Tribes

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ABSTRACT

The annual Smolt Monitoring Program is the result of implementation of Section 304(d)(2) of the Northwest Power Planning Council Fish and Wildlife Program. This is the third year of the annual system-wide program conducted by the Fish Passage Center.

Marked groups of spring, summer, and fall chinook salmon, sockeye salmon, and steelhead trout are monitored at sampling points throughout the system. Because this program is intended to be representative of the juvenile migration, marked groups usually represent major hatchery production stocks. Arrival time and duration of marked groups are reported. Annual travel time indices are reported from Rock Island Dam to McNary Dam, from Lower Granite Dam to McNary Dam, and from McNary Dam to John Day Dam. Travel time indices are calculated for year to year comparison. Hatchery and brand release information is reported. Survival estimates of spring chinook and steelhead hatchery stocks in the mid-Columbia and steelhead hatchery stocks in the lower Snake River are reported.

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Migrational Characteristics and Survival of Columbia Basin
Salmon and Steelhead Trout, 1986

I. INTRODUCTION

This report is the final product of the 1986 implementation of Measures 304 (d)(2) of the Northwest Power Planning Council's (NPPC) Fish and Wildlife Program. This measure requires Bonneville Power Administration (BPA) to fund a program conducted by the fishery agencies and tribes to monitor and report the migrational characteristics of important fish stocks. This was the basis for the Smolt Monitoring Program (SMP). In 1983, the first year of implementation of NPPC program measures, the BPA and fishery agencies and tribes agreed to incorporate the SMP activities into the duties of the Fish Passage Center (FPC). This was done because data from the SMP is necessary for in-season management of the Water Budget and spill.

The SMP provides smolt outmigration and adult passage data on a real time basis to guide system operations. Data are relayed to the Water Budget managers and disseminated to interested parties through a series of weekly reports issued during the migration season. How this information was used by the Water Budget managers in 1986 for in-season management of the Water Budget and in-season management of spill for fish passage and nitrogen abatement was covered in the 1986 Water Budget Managers Annual Report, which was submitted to the NPPC in November, 1986.

The SMP also provides a database for post-season characterization of the outmigration. This characterization includes determination of smolt travel time and survival. Past experimentation and monitoring has correlated decreasing smolt travel time to increasing survival of spring migrants. This was the basis used by the NPPC in establishing the Water Budget program. A key

goal of the SMP has been to collect consistent data on travel time and survival of specific groups to enlarge the database upon which Water Budget measures will be evaluated. The SMP is designed so that data generated on travel time and survival of marked groups may be analyzed relative to flow and other environmental factors on an annual basis.

The SMP is providing information to identify migration requirements of summer juvenile migrants, which are becoming a larger component of the total annual downstream migration. This information aids in directing project operations to facilitate the migration. The SMP also provides baseline data upon which further research can be based.

This report presents the results of post-seasonal analyses including timing and relative magnitude of the outmigration, travel time for marked hatchery releases, and survival in mid-Columbia and lower Snake River index reaches. Travel time of marked yearling and sub-yearling chinook salmon (Oncorhynchus tsawytscha), sockeye salmon (Oncorhynchus nerka), and steelhead trout (Salmo gairdneri) is measured between specific sampling points in the system. Marked groups usually represent major hatchery production stocks. Survival estimates are computed for specific spring chinook and steelhead marked groups. Arrival time and duration of outmigration of the chinook, sockeye, coho (Oncorhynchus kisutch) and steelhead runs are reported at key sampling points. Hatchery and brand release information for 1986 is also listed.

II. SMOLT MONITORING PROGRAM

The 1986 program basically repeated and expanded on the 1984 and 1985 Smolt Monitoring Programs (SMP). Spring, summer and fall chinook and steelhead were marked for the SMP at Columbia River and Snake River system hatcheries above McNary Dam. In addition, in-river yearling chinook and sockeye from Priest Rapids and Wanapum dams were marked by National Marine Fisheries Service (NMFS) as part of a transportation study for Grant County Public Utility District (PUD). At Lower Granite and McNary Dams, in-river yearling chinook and steelhead or sub-yearling fall chinook were marked as part of NMFS research efforts for the U.S. Army Corps of Engineers (COE). These fish plus the SMP fish were used in travel time investigations. Marked fish were recovered at Clearwater and Lewiston traps and at Lower Granite, Lower Monumental, Rock Island, Priest Rapids, McNary, John Day and Bonneville dams (Figure 1).

The type and method of data gathered at each site during 1986 are listed in Table 1. The Clearwater trap site was used for in-season monitoring. The Lewiston trap was used to determine migration characteristics at the head of Lower Granite pool. Fish were sampled in the collection facilities at Lower Granite and McNary dams. In addition, gatewell samples were obtained for Lower Monumental Dam. In the mid-Columbia, the bypass trap at Rock Island Dam was monitored. Gatewell samples were reported for Priest Rapids Dam. This sampling, however, was not consistent and cannot be standardized to provide quantitative estimates. Airlift sampler catches were reported for John Day Dam.

Bonneville Dam again experienced sampling difficulties during the spring migration and most of the summer. Continuous sampling was finally accomplished at the Bonneville 1st powerhouse from mid-August through the end of the bypass season in November. The Bonneville 2nd powerhouse bypass system operated satisfactorily, but inconsistent turbine or powerhouse operations precluded consistent data gathering.

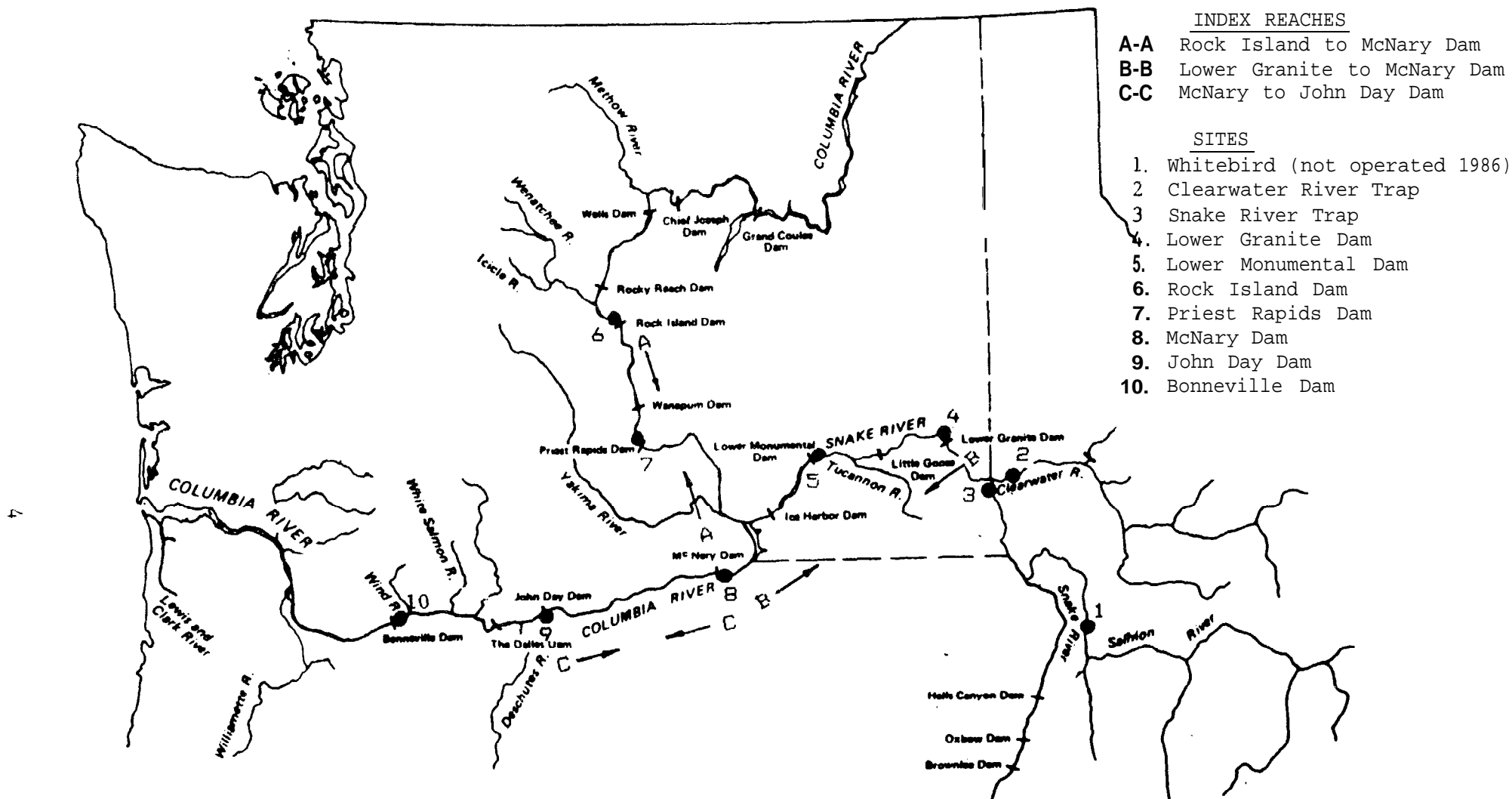


FIGURE 1 1986 SMOLT MONITORING SITES

TABLE 1

FISH PASSAGE CENTER SMOLT MONITORING SITES
1986

<u>Site</u>	<u>Method</u>	<u>Data Gathered</u> ⁽¹⁾
<u>Mid-Columbia</u>		
Rock Island	Bypass Trap	Brands, Species
Priest Rapids	Gatewell Dip	Brands, Species
<u>Snake River</u>		
Snake River Trap	Dipper Trap	Brands, Species
Clearwater Trap	Scoop Trap	Brands, Species
Lower Granite	Bypass/Collection	Brands, Species
Lower Monumental	Gatewell Dip	Brands, Species
<u>Lower Columbia</u>		
McNary Dam	Bypass/Collection	Brands, Species
John Day Dam	Airlift Pump	Brands, Species
Bonneville	Bypass/Collection	Brands, Species

(1) Additional in-season data were obtained from the COE including adult counts, flow, spill, other project operational data, Lower Monumental, Ice Harbor, The Dalles, and John Day hydroacoustic monitoring, and Little Goose collection counts.

Hydroacoustic monitoring was conducted by the COE at The Dalles, Ice Harbor, Lower Monumental and John Day (summer only) dams. The COE will report the results of the hydroacoustic studies.

Data collected at all sites were communicated to the Fish Passage Center and entered into the National Marine Fisheries Service (NMFS) Fish Passage Data Information System (FPDIS) daily. These daily entries were considered preliminary data and were utilized primarily for in-season management decisions by Water Budget managers and other interested parties. Preliminary data were compiled into weekly reports and distributed every Friday to 207 parties, including public and private utilities, federal and state agencies, Indian tribes, and private individuals. After the data collection and migration season was completed, data were verified and edited, if necessary. The final verified data for 1986 mark recoveries at Lewiston, Lower Granite, Lower Monumental, Rock Island, McNary and John Day Dams will be available in a separate volume upon request. Daily sample and collection data will be reported for Lower Granite, Little Goose, and McNary in the 1986 Fish Transportation and Oversight Team (FTOT) report.

III. METHODS

A. Marking Procedures

Fish were marked for survival and travel time evaluation at hatcheries in the Snake and mid-Columbia rivers. All marking was accomplished using freeze branding techniques (Mighell, 1969) which employ silver tipped brass branding rods cooled in a canister containing liquid nitrogen. The brand symbols were transferred to the fish after exposure to the brand tool for about $\frac{1}{2}$ to 1 second. The nitrogen level was serviced every two hours to assure that the brand tool was a constant temperature. Study fish were marked by U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, and Washington Department of Fisheries.

The branding procedure at Wells State Fish Hatchery took place outdoors using portable marking equipment. At other hatcheries, marking trailers were employed as described by Ambrogetti 1976, and Duke 1980. Fish to be branded were brailed into a holding tank and then supplied to the individual markers as they were needed. At Wells Hatchery, an intermediate trough buffered with tricaine methanesulfonate (MS-222) was used to reduce problems and stress of handling large steelhead. Fish were handled and marked in a consistent manner to assure that they were exposed to anesthetic for a minimal time period. The anesthetic solution was constantly diluted due to the activity and number of fish being handled. Following each two hours of operation, all anesthetic solution was discarded and a fresh solution placed into each container. The fish were freeze branded and diverted through a watered conduit to a holding area prior to release. Undersized fish or precocious males were removed from the lots and were not marked.

Personnel selected to do the branding generally lived in the vicinity of the fish hatchery and had varied marking experience. All branders received a brief

demonstration and critique of methodology by experienced supervisors. In order to randomize branding of survival groups, branders rotated among the branding stations to prevent marking bias. Since fish might originate from different raceways or ponds within a hatchery, paired test and control groups were branded at the same time to reduce the possibility that fish in each group would be different. Further, since the numbers of fish in test groups were greater than paired controls, the number of people branding each group were adjusted to maintain the ratio of test to control fish throughout the branding process.

Yearling chinook were marked well in advance of their release dates. Steelhead and sub-yearling chinook were marked within weeks of their release date.

Hatcheries were chosen to represent major production releases, and to be representative of the migration as a whole (Table 2). Fish were marked in sufficient numbers to provide for an adequate number of recoveries, as well as a good pattern of recoveries at the sampling sites under the established sampling rates. Approximately 52% of the fish freeze branded in 1986 were done as part of the SMP (Table 3). Release data for all marked hatchery groups are provided in the Brand Release Report Tables (Appendix I). Marking dates for SMP groups are also noted in Table 4.

1. Fish and Brand Quality Observations

After branding was completed at the hatchery, fish were sampled periodically for assessment of brand and fish quality. Generally, the branded fish were examined following at least a 5-day lapse after branding to assure that brands were fully developed. A sample of 100 to 200 fish were observed from a representative cross section of the marked fish. These fish were anesthetized with a MS-222 solution. Fish were individually inspected and rated for brand quality using the categories in Table 5. These categories were developed and used by sampling personnel throughout marking programs in 1986. Fork length

TABLE 2

SMOLT MONITORING PROGRAM: HATCHERY & RELEASE SITES
1986

<u>Hatchery</u>	<u>Species</u>	<u>Release Site</u>	<u>Number (X1000)</u>
<u>Snake River</u>			
Dworshak	Sp.Ch.	Dworshak	41.6
Sawtooth	Sp.Ch.	Sawtooth	35.9
Rapid River	Sp.Ch.	Hells Canyon	44.8
Rapid River	Sp.Ch.	Rapid River	44.7
McCall	Su.Ch.	S.Fork Salmon	43.5
Dworshak	SH	Dworshak	35.4
Niagra Springs	SH	Hells Canyon	51.3
Hagerman	SH (A)	E. Fork Salmon	51.8
Hagerman	SH=(B)	Sawtooth	52.3
*Lyons Ferry	SH	Little Goose	60.0
*Lyons Ferry	SH	below Ice Harbor	36.0
Lyons Ferry	Fa.Ch.(Yr.)	Lyons Ferry	40.0
Lyons Ferry	Fa.Ch.(S.Y.)	Lyons Ferry	<u>80.0</u>
		Subtotal	617.3
<u>Mid-Columbia</u>			
*Winthrop	Sp.Ch.	Winthrop	103.3
*Winthrop	Sp.Ch.	Priest Rapids	35.9
Leavenworth	Sp.Ch.	Leavenworth	40.0
*Wells	SH	Pateros	90.0
*Wells	SH	Priest Rapids	36.0
Wells	Su.Ch.	Wells	100.0
Priest Rapids	Fa.Ch.(S.Y.)	Priest Rapids	199.5
Ringold	Fa.Ch. (Yr.)	Ringold	<u>50.0</u>
		Subtotal	654.7
		Total	1,272.0

*

Groups used to calculate survival estimates to McNary Dam.

TABLE 3 Total numbers of freeze branded fish released above Bonneville Dam
in the Columbia River Basin.

Number of Freeze Branded Fish (X 1000)				
<u>Release</u> <u>Reach</u>	<u>FPC</u> <u>Hatchery</u>	<u>Other</u> <u>Hatchery</u>	<u>In-River</u> <u>(Non-hatchery)</u>	<u>Totals</u>
Snake	617.3	587.7	96.2	1,301.2
Mid-Columbia	654.7	83.2	178.3	916.2
Lower Columbia*	<u>--</u>	<u>--</u>	<u>239.9</u>	<u>239.9</u>
TOTAL:	1,272.0	670.9	524.4	2,457.3

*
Lower Columbia from McNary to Bonneville Dam

TABLE 4 Dates of freeze branding juvenile salmonids at Columbia Basin hatcheries for the 1986 Smolt Monitoring Program.

<u>Hatchery</u>	<u>Species</u>	<u>Brand</u>	<u>Date Branded</u>
<u>WASHINGTON</u>			
Lyons Ferry	Steelhead	RA-7F-1,3, RD-7F-1	3/25-27/86
		LA-7U-1,3, LD-7U-1	
	Fall Chk	RA-7K-1	3/31/86
		RA-T-3	5/20,21/86

Wells	Steelhead	LA-7N-1,3, LD-7N-1	4/28-5/7/86
		RA-7P-1,3, RD-7P-1	
	Summer Chk	RD-s-1	5/12-14/86

Priest Rapids	Fall Chk	LA-T-1,4	5/27-31/86

Leavenworth	Spring Chk	LA-7T-1	10/2/85

Winthrop	Spring Chk	RA-7C-1,3 RA-7T-3	9/23-27/85
		LA-7C-1,3 LA-7U-1	

Ringold	Fall Chk	RA-7U-3	11/19-20/85

<u>IDAHO</u>			
Rapid River	Spring Chk	LD-Y-1,3	2/10-12/86

Sawtooth	Spring Chk	RD-Y-1	9/30-10/3/85

Dworshak	Spring Chk	RA-Y-2	11/20/85
	Steelhead	RD-T-4	4/1/86

McCall	Summer Chk	RD-Y-3	11/5,6/85

Hagerman	Steelhead	LD-T-2,4	3/10,12/86

Niagara Sprgs	Steelhead	RD-T-2	3/5/86

of each fish was measured to the nearest 5mm. To assess if the branding operation was biased for fish length, the unbranded source population was also sampled and measured for fork length. The sample was obtained without replacing previously inspected fish into the unsampled population.

Later, checks on brand quality were periodically made at the recovery sites. In these checks, quality codes 3,4, 5, and 6-3 were not useable since marked fish were mixed with unmarked fish or other mark groups. For the survival studies, a facet of the assumption of equal sample rates on the test and control groups is that the brand readability is the same for the two groups. Naturally, it is also advantageous that the readability be high.

TABLE 5 FREEZE BRAND QUALITY CRITERIA

<u>Category</u>	<u>Definition</u>
1.	Brand is complete and legible.
2.	Brand is legible but defective in some manner. For example, a non-critical part of the brand is missing or is not well developed and light.
3.	The brand is not legible.
4.	The brand rotation or position is wrong.
5.	No brand.
6.	The brand caused light, moderate, or excessive burning of the fish or has become ulcerated, recorded as quality code 1, 2, or 3, respectively.

2. Additional Methods Specific to Survival Groups

A total of 18 distinct mark codes were applied to spring chinook and steelhead as part of the 1986 survival monitoring program. Numbers of fish, mark codes, and release sites are listed in Table 6. Mark recapture data for these groups are presented in Volume II. Mark codes are described in the format of position-mark-rotation. The position codes are RA for right anterior and LA for left anterior portions of the fish. Rotation codes designate one of

TABLE 6 1986 Smolt Survival Freeze Brands Release Data

Hatchery: Winthrop						
Species: Spring Chinook						
<u>Brand</u>	<u>Code</u>	<u>Release Site</u>	<u>Release Date</u>	<u>No. Released</u>		
RA-7C-1	WiT1	Winthrop Hatchery	April 21	34,466		
LA-7C-3	WiC1	Below Priest Rapids	April 21	12,001		
RA-7C-3	WiT2	Winthrop Hatchery	April 25	34,485		
LA-7C-1	wic2	Below Priest Rapids	April 25	11,989		
RA-7T-3	WiT3	Winthrop Hatchery	April 29	34,353		
LA-7U-1	WiC3	Below Priest Rapids	April 29	11,904		

Hatchery: Wells						
Species: Summer Steelhead						
<u>Brand</u>	<u>Code</u>	<u>Release Site</u>	<u>Release Date</u>	<u>No. Released</u>		
LA-7N-1	WeT1	Effy Bridge, Methow R.	May 1	29,451		
RA-7P-1	WeC1	Below Priest Rapids	May 1	11,780		
LA-7N-3	WeT2	Effy Bridge, Methow R.	May 5	30,046		
RA-7P-3	WeC2	Below Priest Rapids	May 5	11,575		
LD-7N-1	WeT3	Effy Bridge, Methow R.	May 9	29,992		
RD-7P-1	WeC3	Below Priest Rapids	May 9	11,943		

Hatchery: Lyons Ferry						
Species: Summer Steelhead						
<u>Brand</u>	<u>Code</u>	<u>Release Site</u>	<u>Release Date</u>	<u>No. Released</u>		
RA-7F-1	LyT1	Below Little Goose	April 21	20,035		
LA-7U-1	LyC1	Below Ice Harbor	April 21	11,998		
RA-7F-3	LyT2	Below Little Goose	April 25	20,063		
LA-7U-3	LyC2	Below Ice Harbor	April 25	12,034		
RD-7F-1	LyT3	Below Little Goose	April 29	20,069		
LD-7U-1	LyC3	Below Ice Harbor	April 29	12,018		

four possible rotations starting at zero degrees and incrementing 90 degrees for each of the subsequent three rotations. For instance, the code RA-7T-02 is the 7T brand rotated clockwise 90 degrees and applied to the right anterior part of the fish. To facilitate the following discussion, these codes are simplified to a text code. In this code, the hatchery is designated by the initial two letters: "Wi" signifying Winthrop Hatchery, "We" signifying Wells Hatchery, and "Ly" signifying Lyons Ferry Hatchery. This is followed by a T or C representing test or control group, followed by the replicate number 1,2, or 3. For instance, the text code LyC2 is the second replicate of the control group from Lyons Ferry Hatchery. The cross reference of these text codes with the original freeze brand codes also is listed in Table 6.

Employing normal hatchery practice, the spring chinook from Winthrop Hatchery were marked in the preceding fall, while the steelhead from Wells and Lyons Ferry hatcheries were marked just prior to release. Because of raceway space requirements, the marked control groups at Winthrop Hatchery were held at a lower density through the winter than were the test groups. This results in the Winthrop control fish being larger size than the test fish at release. The branded fish were held in normal concrete hatchery raceways until release at Winthrop and Lyons Ferry hatcheries, and in portable vinyl raceways at Wells Hatchery.

Spring chinook test groups from Winthrop Hatchery were released at the hatchery and were not transported prior to release (Figure 2). Three test groups were released at four day intervals. Fish were released from the hatchery by removing the outlet screens and lowering the water level. Control fish were transported by truck on the same day as the test release to below Priest Rapids Dam, a distance of 160 miles and a driving time of 3½ hours. Fish were transported in a 1,200 gallon tanker filled with recirculating

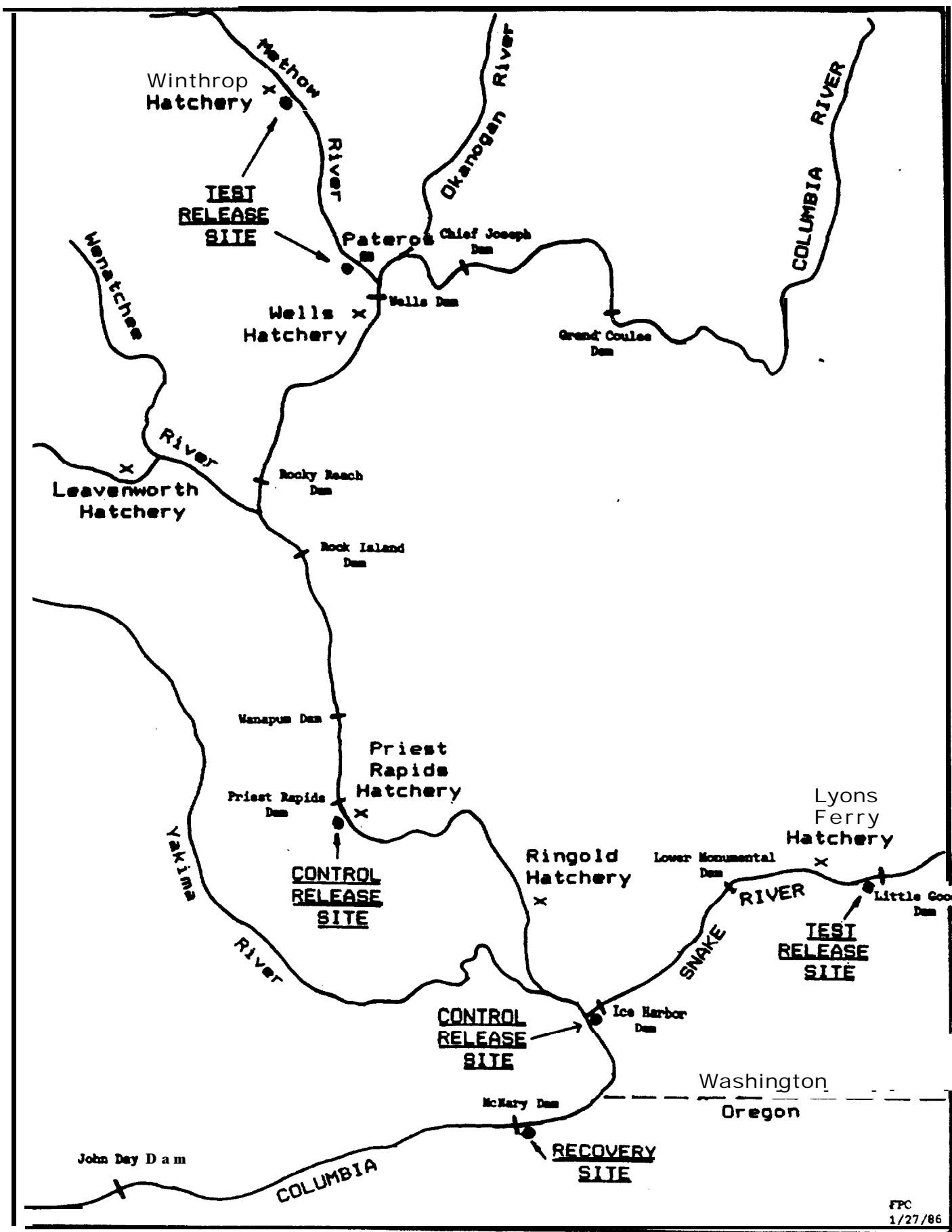


FIGURE 2 Mid-Columbia and lower Snake River area showing release sites for 1986 spring chinook and steelhead survival study.

hatchery water which was kept aerated with oxygen. Density in the transport truck was 0.7 pounds of fish per gallon of water.

Steelhead test groups from Wells Hatchery were trucked 30 minutes to a release site located about 10.0 miles upstream from the mouth of the Methow River (Figure 2). The distance from the hatchery was about 20 miles. Three test groups were released at four day intervals. Control fish were transported for $2\frac{1}{2}$ hours, a distance of 120 miles to below Priest Rapids Dam. Two loads were required to transport the control fish below Priest Rapids Dam. One load generally left the hatchery at about 8 a.m. and the other at 2 p.m. Control groups were released on the same day as the test groups. Fish were transported in a 1,500 gallon tanks at a density of 1.0 and 0.8 pounds of fish per gallon of water, for test and control groups, respectively.

Lyons Ferry steelhead test and control groups were trucked to release sites below Little Goose and Ice Harbor dams in a 5,000 gallon tanker at a density of 0.7 and 0.4 pounds of fish per gallon of water, respectively (Figure 2). The test group release site was about 10 miles from the hatchery, or about 20 minutes driving time. Three test groups were released four days apart. Control groups were trucked to below Ice Harbor Dam, a distance of 55 miles and a driving time of 90 minutes. Control groups were released on the same day as the test groups.

At each station, the density of fish in the transport vehicle varied depending on the truck size and number of fish hauled per load. The fish hauling densities which were used in 1986 fell within the normal hatchery criteria for transporting fish. Most hatcheries haul fish at about 1.0 pound or less of fish per gallon of water.

B. Analytical Procedures

1. Magnitude of the Migration

Annual passage indices were established at McNary, Lower Granite, Rock Island, and John Day dams. The passage index represents the daily estimated collection of fish at a project divided by the proportion of water passing through the powerhouse on that day. The second powerhouse flow at Rock Island and the unit 3 flows at John Day and Lower Monumental were used to estimate the passage index. This procedure was used to correct daily collection totals for changes in powerhouse operations. This approach is dependent upon the assumption that collection efficiency of these sampling systems is related in a linear fashion to the proportion of river flow through the powerhouse. These corrected indices can be compared with indices for 1984 and 1985 at McNary and Lower Granite Dams, but only with 1985 indices at Rock Island Dam. Comparisons to 1985 are valid only for sub-yearling chinook at John Day Dam. These indices are the annual sums of the daily migration indices for a species. These annual indices are not estimates of total passage, nor are they comparable between projects or species within a year. These indices will allow comparisons of the size of the outmigration between years within a species at individual projects.

2. Smolt Arrival Timing and Duration

The migration of each species past Rock Island, Lower Granite, and McNary dams was characterized by the date that 10%, 50%, and 90% of the population had passed the project. The median point was used for comparison between species while the 10 and 90 percent dates illustrate when the bulk of the fish migrate through that project. These dates are computed by using the passage index as the basis statistic. The duration of the migration was computed as the number of days between the 10% and 90% dates of passage at a project.

3. Travel Time Determination

Travel time can be viewed as the number of days on average required for fish to travel a specific river reach. Smolt travel time is determined in two ways. Travel time was calculated as the number of days between release date and median date (the date on which 50% of the marked group had passed the project) of passage at a downstream site. The median was used rather than the average because the median is less sensitive to extended tails (late mark arrivals) that occur in mark recovery data. The travel time index was calculated as the number of days between the median dates of passage at selected recovery points. The smolt travel time index differs from travel time in that it measures a fixed river reach outside the influence of the release site. The smolt travel time index is measured between points located some distance below the point of release in order to exclude the effect of initial hatchery mortality, migration delay or other variables which might act to affect the natural migration response. This will allow statistical comparisons between years relative to flow and other environmental conditions.

Before determining travel time, the mark recovery distribution was examined at each of the projects between which travel time was to be computed. This evaluation looked at size of the recovery sample and whether the pattern of mark recoveries was representative of the passage past the recovery point. For each brand group, the number of fish sampled at each recovery site is shown in Appendix II. Rejection of groups for analysis was primarily due to small sample sizes. When total number of fish from one brand group is less than 200, the pattern of the recovery distribution is sometimes very poor. On the other hand, some marked groups may be accepted with sample sizes as low as 35 to 50 recoveries, because they have a very pronounced distribution over a short time period with the median date falling on or near peak days of passage. In

general, all groups with less than 200 recoveries are reviewed to determine if the recovery distribution is adequate to produce a reliable median date of passage.

The accuracy of travel time estimates from release sites to downstream recovery points is reduced when release dates are not exact. When groups were released volitionally or over a period of days, the middle release date or date when 50% of fish released, respectively, was used in estimating travel time.

Individual and average migration speeds of the marked groups between release and recovery points and within index reaches were also obtained. Migration speed eliminates the effect of varying distances marked groups travel and allows comparison between groups and areas. Speed was calculated by dividing the travel time in days into the distance traveled in miles. For marked groups traveling the same distance, average migration speed was computed by dividing the average travel time into the reach distance. In instances where marked groups are traveling different distances, a simple average of individual speeds was computed.

The three key travel time index reaches used in 1986 were (i) Rock Island Dam to McNary Dam in the mid-Columbia; (ii) Lower Granite Dam to McNary Dam in the Snake River; and (iii) McNary Dam to John Day Dam in the lower Columbia (Figure 1). When consistent sampling at Bonneville Dam is established, in the future, the lower Columbia index reach will be from McNary Dam to Bonneville Dam. Non-key travel time index reaches include Lewiston trap to Lower Granite Dam, Lower Granite Dam to Lower Monumental Dam, Little Goose Dam to Lower Monumental Dam, Lower Monumental Dam to McNary Dam, Ice Harbor Dam to McNary Dam, and Priest Rapids Dam to McNary Dam.

An annual travel time index was calculated for each key index reach by averaging travel time indices of those marked groups which are treated as replicates. An annual index of average migration speed was also calculated within the index reaches.

The passage index is the basic data used for travel time analysis at hydroprojects, whereas raw collection numbers are used at Idaho trap sites. Information on collection efficiencies and mark recaptures at Idaho trap sites are published in annual reports by Idaho Department of Fish and Game (IDFG) submitted to BPA.

Travel time determination for steelhead groups from points of release above Lower Granite to McNary and John Day was limited because of the large number of fish removed from the river in the transportation program.

4. Survival Studies

The FPC survival monitoring program is designed to determine annual indices of smolt survival which can be statistically compared year-to-year. Smolt survival was determined by the indirect method which uses the ratio in proportion of marks recovered at a downstream sample site for test and control groups. The test group of marked fish is released at the top of the river reach of interest, and a control group is released near the bottom of the reach. Both mark groups are recovered at a downstream collection point, and survival between the test and control release points is determined as the ratio in the proportion recovered of the two groups. This technique assumes that both groups are assumed equal in all respects except for the test group experiencing passage conditions in the river reach of interest. This implies that both groups are (1) collected at the recovery site at equal rates, and (2) treated identically prior to release.

It is impossible to fully meet both of these assumptions in any study design because of logistical and practical considerations. For instance, in order to meet the first assumption, the release of the control groups can be delayed relative to release of the test groups so that both migrate past the collection point simultaneously. While this helps to insure that both groups

are collected at the same rate, additional stresses resulting from a longer holding period are placed on the control fish which are not present in the test groups, thus violating the second assumption. These additional stresses can be significant. Evidence is available to suggest that the proportion recovered, and therefore survival, of sequentially released mark groups declines over time. This may be due to additional holding stresses on the later released fish (McConnaha and Basham, 1985). Because survival is measured as the ratio in proportion recovered of test and control groups, this factor may falsely increase the estimated survival of the test groups.

The relative timing of marking and releasing the test and control groups affects the degree to which the design assumptions are met. Test and control fish for each replicate were marked simultaneously with fish from the same hatchery group. Both test and control fish for a particular replicate were released on the same day. This was because the increased stress and mortality in trying to hold actively smolting controls longer at the hatchery in order to attempt to achieve mixing of test and control fish at the recovery site was found to be unacceptable in the 1984 and 1985 studies. The goal of mixing is unattainable when the distances between test and control release are so large.

Since it is impossible to achieve true mixing, a correction for different powerhouse operation each day was used. The factor used for correcting for powerhouse operations is the proportion of river flow passing through the powerhouse on a given day. This assumes a direct and linear, although unknown, proportionality between collection efficiency and proportion of flow passing the powerhouse during recovery of the mark groups. Errors involved in making this assumption appear to be less critical than the error induced by holding actively smolting control groups in a close environment longer than the test groups.

Statistical error was computed for individual survival estimates and for the

mean survival of the three replicate estimates. The individual variance was computed using the second-order Taylor series expansion of the ratio of two random variables (McKenzie, et.al.1985), based on the binomial distribution of recoveries. These variances must be calculated using either raw recovery counts or adjusted values similar in magnitude. For freeze branded groups which are sub-sampled at McNary, this means that variances should be based on unexpanded sample numbers which have had the flow adjustment mentioned above. However, since sub-sampling rates do vary between days, it was necessary to adjust sample counts to a base sample rate of 10% of the collection. This is equivalent to using a passage index that is 1/10th the magnitude of the standard FPC passage indices. This index was divided by the number of fish released in the mark group to provide the proportion of marked group in the sample. The ratio of these proportions for test and control groups gives the survival from the test release point to the control release point (Table 7). Standard error about the mean survival of a group was computed as the variability among replicate releases.

TABLE 7 Formula for calculating survival and variance estimate for each replicate (adapted from McKenzie et al. 1985):

Survival estimate:

$$\hat{S} = \frac{\left[\left(\sum I_{ti} \right) / N_t \right] \frac{1}{10}^{P_T}}{\left[\left(\sum I_{ci} \right) / N_c \right] \frac{1}{10}^{P_c}}$$

$$I_{ti, ci} = R_{ti, ci} / (f_i L_i)$$

Variance Estimate

$$\text{var} (\hat{S}) = \text{var} \left(\frac{P_T}{P_c} \right) = \hat{S}^2 \left(\frac{1 - P_T}{N_T P_T} + \frac{1 - P_c}{N_c P_c} \right)$$

where,

\hat{S} = Estimated survival of the test group from the test group release point to the control group release point.

N_t, N_c = Number of marked fish in the initial release of the test and control groups, respectively.

$R_{ti, ci}$ = Number of test and control marks observed in the sample on day i.

$I_{ti, ci}$ = Collection index of test and control groups on day i.

f_i = Proportion of time that the collection system is sampled on day i.

L_i = The proportion of the river flow passing through the powerhouse on day i.

P_T, P_c = Proportion of test and control marks collected in a base 10% sample.

IV. RESULTS

A. 1986 Runoff

The 20-year period of 1961 through 1980 has been adopted by the Columbia Basin Water Management Group as the basis for determining the average January through July seasonal runoff. The average January through July runoff for the 1961 through 1980 period is 30.1 million acre feet (MAF) above Lower Granite, 64.8 MAF above Grand Coulee, and 107.0 MAF at The Dalles. Determination of whether the current year is above or below average is made against this basis.

1. Snake River Drainage

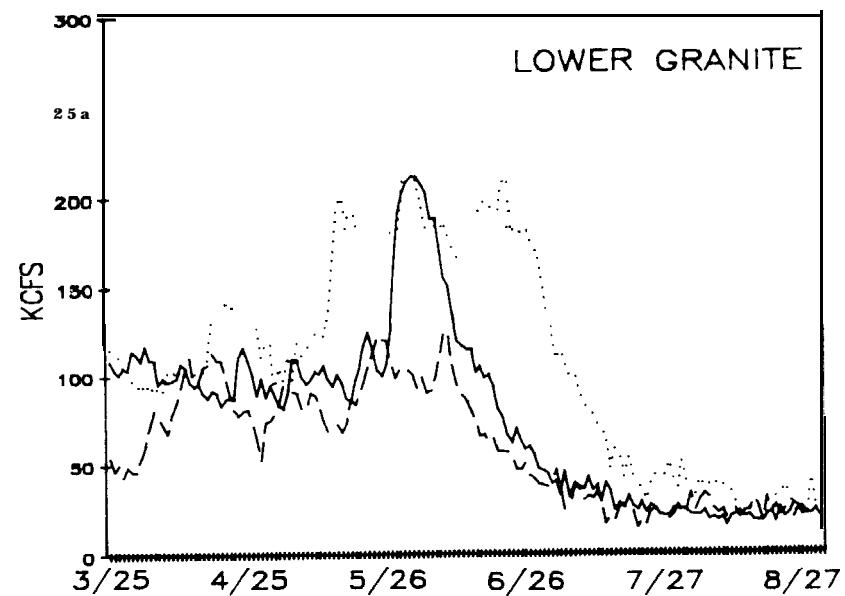
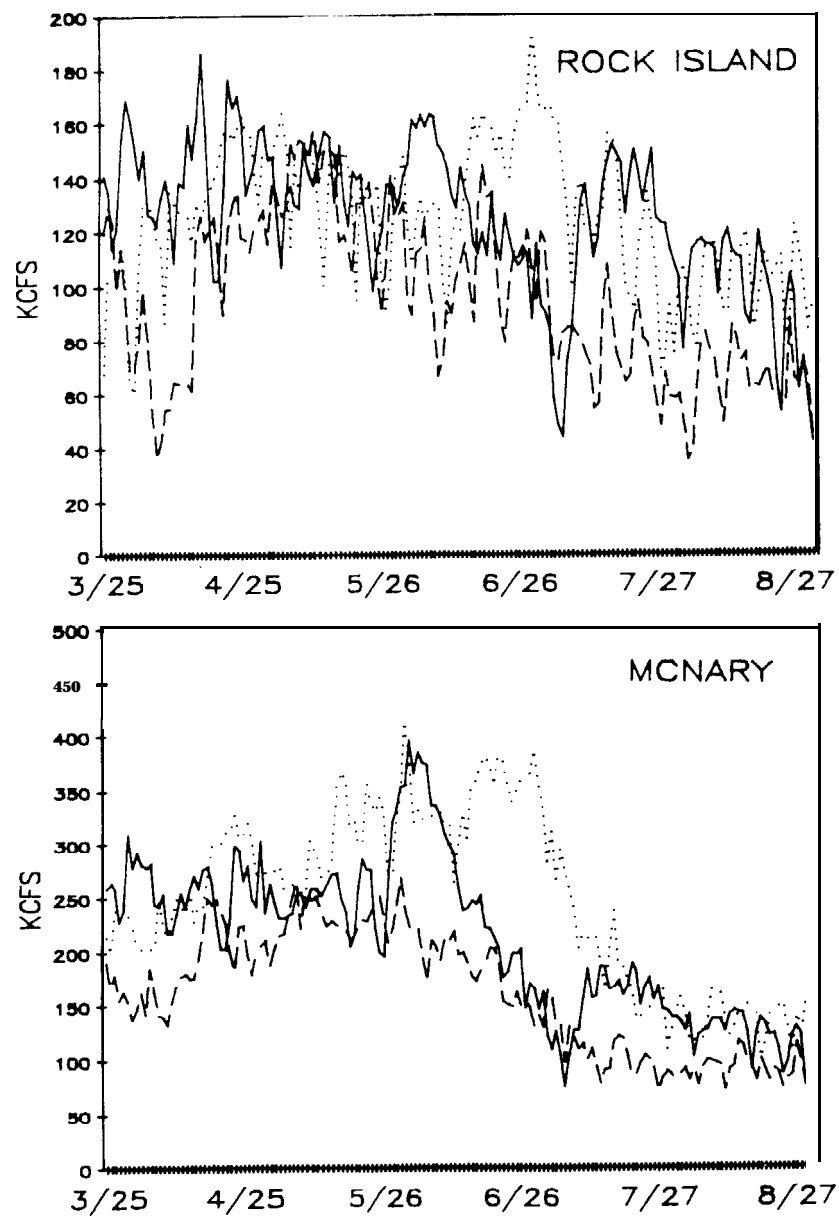
Observed runoff above Lower Granite contributing to the 1986 January - July runoff total was 36.4 MAF (121% of the 20-year average). This compares to observed runoff of 43.9 MAF (146% of 20-year average) and 25.2 MAF (84% of 20-year average) in 1984 and 1985, respectively.

Flows at Lower Granite were substantially lower than 1984 levels and higher than 1985 levels (Figure 3). During the 60-day period from April 15 through June 15, flows at Lower Granite were below the 85 kcfs level for only 1 day in 1986, whereas flows were below that level 2:2 days in 1985.

2. Mid-Columbia Drainage

Observed runoff above Grand Coulee contributing to the 1986 January - July runoff total was 59.6 MAF (92% of 20-year average). This compares to observed runoff of 52.2 MAF (81% of 20-year average) and 52.1 MAF (80% of 20-year average) in 1984 and 1985, respectively.

Flows at Rock Island were more similar to 1984 levels than 1985 levels throughout the spring and summer migration (Figure 3). Flows in 1986 took their largest dip during the Fourth of July holiday period. Flows through August were near 100 kcfs most of the time, like in 1984. This was a major improvement over conditions experienced in 1985, which was one of the lowest summer flow years occurring in 50 years.



LEGEND

— 1986

-- 1985

..... 1984

FIGURE 3 River Flow at Rock Island, McNary, and Lower Granite, 1984, 1985, & 1986.

3. Lower Columbia Drainage

Observed runoff at The Dalles in 1986 was 108.3 MAF, a little above the official 20-year average. This compares to observed runoff of 119.1 MAF (111% of 20-year average) and 81.7 MAF (82% of 20-year average) in 1984 and 1985, respectively.

Flows at McNary were consistently lower than 1984 levels and higher than 1985 levels (Figure 3). Average river flows were above the fishery minimum of 220 kcfs most of the 1986 spring migration, except on weekends.

4. Spill Conditions

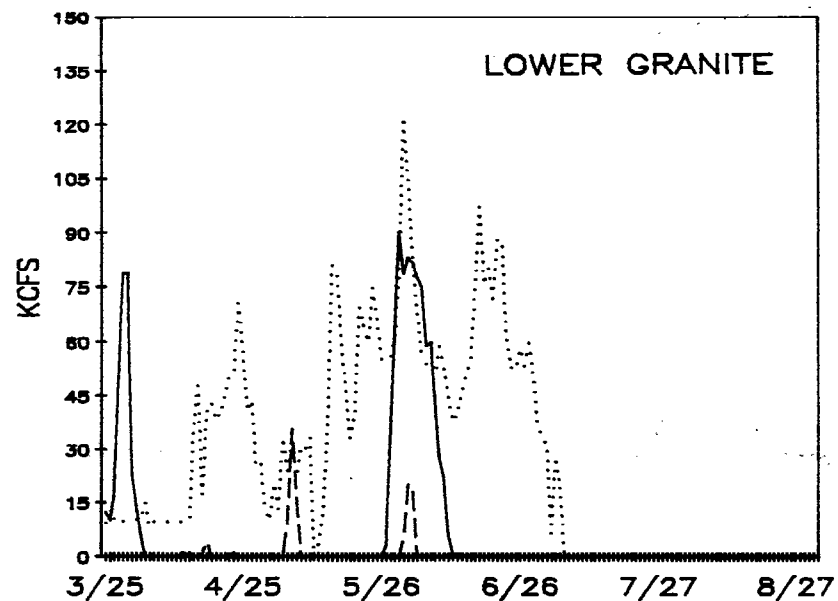
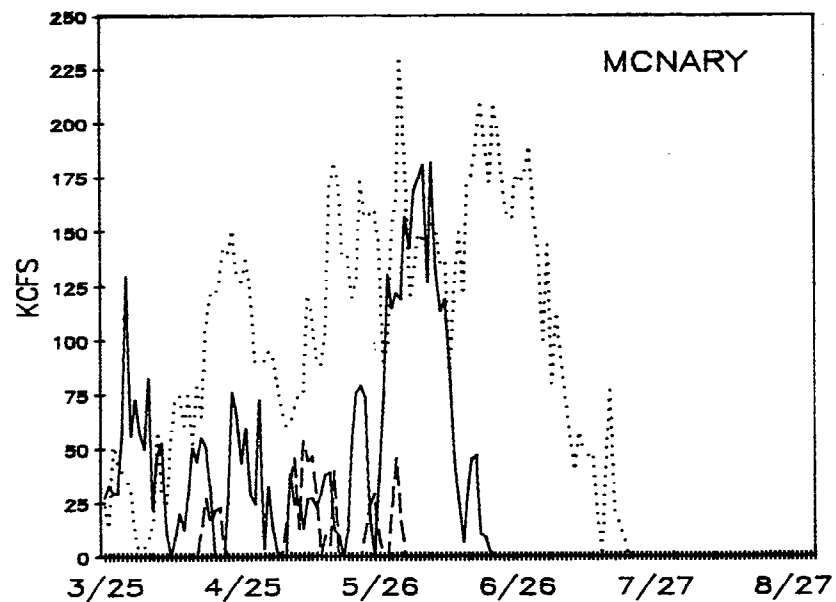
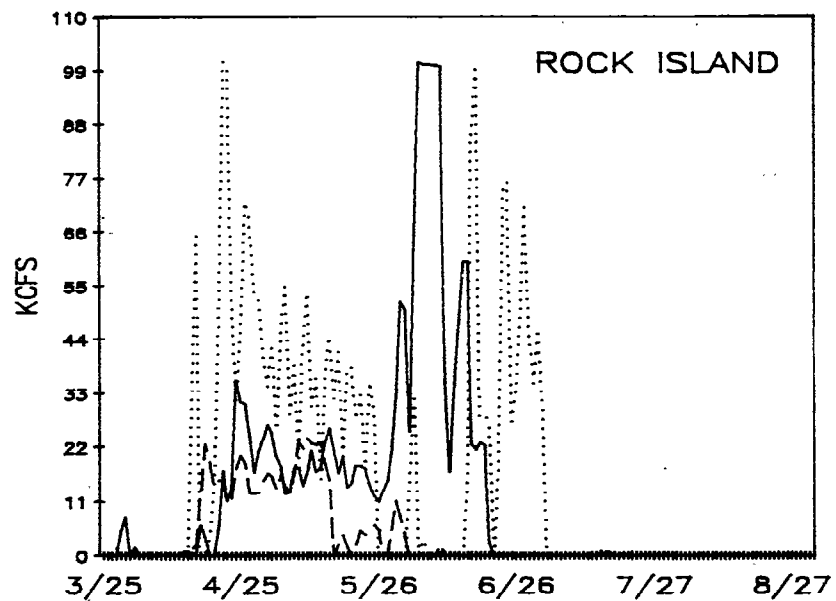
High levels of spill occurred during the 1986 spring smolt migration due to high flows from the end of May through the first week of June. This resulted in high levels of nitrogen gas supersaturation in the lower Snake and lower Columbia rivers. For a time, spill was transferred from the lower Snake to the mid-Columbia to alleviate this problem. Overall the impacts of supersaturation from McNary to the estuary appeared minimal to juvenile and adult salmonids (Dawley, 1986).

Spill during the 1986 summer migration was limited. From mid-June to mid-August, spill occurred at The Dalles and John Day dams and from mid-July to mid-August Wanapum Dam provided spill.

The amount and duration of spill is compared among years for Rock Island, McNary and Lower Granite dams in Figure 4. In general, 1986 can be viewed as an intermediate spill year between the high spill of 1984 and low spill of 1985 at these projects.

5. Smolt Passage Conditions

In general, smolt passage conditions during the spring migration appear more favorable in 1986 than 1985, and less favorable than in 1984. Flows in 1986 were above the fishery minimums throughout most of the spring migration. High nitrogen gas supersaturation levels had minimal impact on juvenile salmonids. River temperatures remained below 60°F throughout the spring migration period (Figure 5),



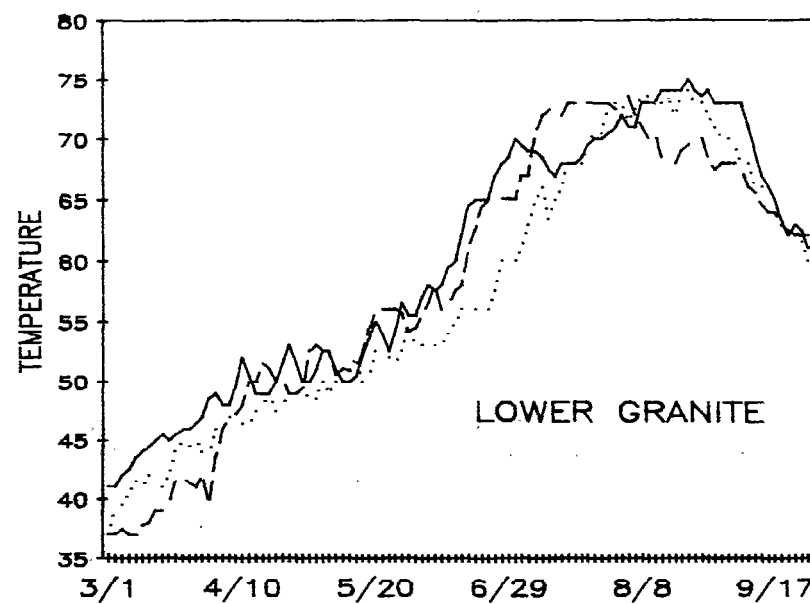
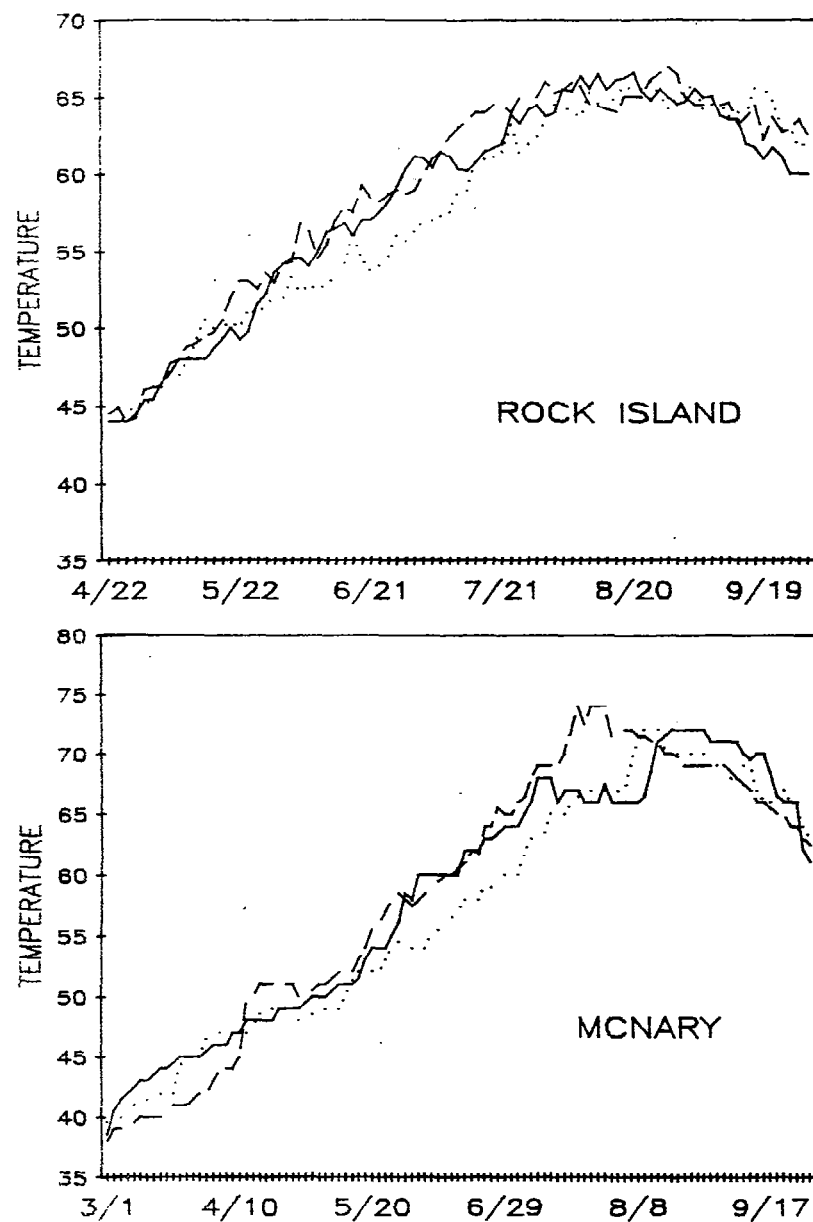
LEGEND

— 1986

-- 1985

.... 1984

FIGURE 4 Spill Levels at Rock Island, McNary and Lower Granite, 1984, 1985, & 1986.



LEGEND

- 1986
- - 1985
- 1984

FIGURE 5 River Temperature at Rock Island, McNary and Lower Granite, 1984, 1985, & 1986.

Smolt passage conditions during the summer migration also appear more favorable in 1986 than 1985, and probably equal to 1984. Flows in July and August were similar between 1984 and 1986 at McNary, and much better than those of 1985 (Figure 5). Water temperatures at McNary remained below 70°F until after mid-August in 1986, whereas temperatures that high appeared about one week earlier in 1984 and one month earlier in 1985 (Figure 5).

B. Passage Indices

An index of total passage by species for several projects is presented to permit year-to-year comparison of the magnitude of the outmigration. These indices are the annual sum of the daily passage indices (daily collection divided by the proportion of river flow through the powerhouse). The annual passage indices are not estimates of total passage; but rather, they provide relative measures of run magnitude. Since collection efficiencies differ among species and projects, the passage indices are not comparable among projects and among species within a year. They should, however, provide accurate comparisons of run size changes over years for a species at a particular point, provided collection efficiency remains relatively stable among years.

Total 1986 passage indices are reported in Table 8 for Lower Granite, Rock Island, and McNary dams. These index the outmigration by species for each major river reach. Comparisons are made with 1984 and 1985 passage indices. How large a relative change between two annual passage indices must be in order to be considered significant is not known. However, it appears that changes of less than 25% are probably minor, 25 - 99% are moderate, and over 100% are major changes in run magnitude.

Much smaller changes in the annual passage indices at Lower Granite occurred between 1985 and 1986 than had occurred between 1984 and 1985. Minor changes between 1985 and 1986 were: a 7% decrease for yearling chinook, and increases

TABLE 8 Total Passage Indices at Columbia Basin Projects 1984 - 1986.

Project	1986		1985		1984	
	Collection Index		Collection Index		Collection Index	
Lower Granite						
Yrlg. Chk.	1,620,361	1,645,170	1,742,244	1,768,547	828,332	1,112,829
Sub-Yrlg. Chk.	53,576	55,098	44,008	44,008	97,639	132,582
Steelhead	3,094,104	3,274,159	2,689,579	2,803,144	1,114,740	1,589,910
Sockeye	7,199	7,624	6,467	6,519	11,152	15,803
Coho					256	--
Rock Island						
Yrlg. Chk.	20,479	26,116	32,399	38,891	N/A	N/A*
Sub-Yrlg. Chk.	44,799	72,981	21,082	24,374	N/A	N/A
Steelhead	31,108	38,893	30,129	34,254	N/A	N/A
Coho	48,516	59,305	12,037	13,654	N/A	N/A
Sockeye	31,286	42,811	31,202	36,804	N/A	N/A
McNary						
Yrlg. Chk.	2,486,407	2,917,112	2,952,613	3,116,140	1,261,187	2,085,232
Sub-Yrlg. Chk.	6,049,724	6,615,443	6,524,570	6,531,412	4,098,004	5,348,554
Steelhead	716,337	878,295	840,037	881,698	610,511	1,051,936
Coho	80,422	111,175	71,752	72,107	82,144	149,250
Sockeye	796,855	1,043,376	1,029,832	1,075,970	191,930	315,313

*

Rock Island monitoring was not continuous in 1984.

of 25% for sub-yearling chinook, 17% for steelhead, and 17% for sockeye. The increase in sub-yearling chinook may be attributed to the approximately 380,000 age 0 spring chinook of yearling size released in the Grande Ronde River from Irrigon Hatchery in mid-June. Moderate changes between 1984 and 1985 were: increases of 59% for yearling chinook and 76% for steelhead, and decreases of 67% for sub-yearling chinook and 59% for sockeye.

A continuing problem at Lower Granite (and, indeed, at all projects) is the differentiation between yearling and sub-yearling chinook. At the start of 1986 sampling season, size was used as the main differentiation criteria. However, with the release of large size sub-yearling spring chinook in the Grande Ronde River from Irrigon Hatchery during June, a change was made to the use of morphological characteristics to separate this hatchery stock from yearling chinook stocks. This created additional difficulty in the classification of smolts at the project. Originally, morphological characteristics have been used to separate fall chinook and spring chinook races; now they are being used to separate hatchery stocks within a given race. In 1985, no firm criteria for separation was established, which probably resulted in the use of a combination of size and morphological characteristics as criteria.

A large increase in the annual passage indices at Rock Island occurred between 1985 and 1986 for sub-yearling chinook and coho. The 1986 annual passage index increased 199% over the 1985 level for sub-yearling chinook, and 334% for coho. Passage indices decreased 33% for yearling chinook and increased 14% for steelhead and 16% for sockeye. The decrease in yearling chinook cannot be attributable to changes in spring chinook releases from Leavenworth and Winthrop hatcheries, since nearly identical numbers were released. As discussed later in Section V, higher spill efficiency than assumed in the passage index adjustment may account for some of this difference. The reason for the

three-fold increase in the sub-yearling chinook passage index may have resulted from the high spring flow causing a great proportion of wild as well as hatchery fish to be collected (Steve Hayes, Chelan PUD, personal communication). The four-fold increase in coho is attributable to the four-fold increase in numbers of coho released on-site at Rocky Reach Hatchery in 1986.

Only minor changes in the annual passage indices at McNary occurred between 1985 and 1986, with the exception of coho. The changes between 1985 and 1986 were decreases of 6% for yearling chinook, 0.4% for steelhead, and 3% for sockeye, and increases of 1% for sub-yearling chinook and 54% for coho. Since the majority of the coho reared at Rocky Reach Hatchery were outplanted in the Yakima River in 1985, the magnitude of the change in passage indices between years at McNary was much smaller than that at Rock Island.

Much larger changes in the annual passage indices at McNary occurred between 1984 and 1985. Increases of 49% for yearling chinook, 22% for sub-yearling chinook, and 241% for sockeye, and decreases of 16% for steelhead and 52% for coho were measured for those years.

C. Migration Timing

1. Snake River Traps

The first indication of fish movement out of the upper Snake system is provided by the traps located on the Clearwater and Snake Rivers near Lewiston, Idaho, operated by the IDFG. Further details on the operation of these traps in 1986 will be provided in an annual report from IDFG. For the Smolt Monitoring Program, both of these traps provide qualitative information on smolt movement, and the information is largely used for in-season management of downstream projects. The Clearwater and Snake River traps operated continuously from March 12 to May 27, and March 15 to May 29, respectively, until they were removed due to high water conditions. The Snake River trap was operated again

beginning June 17 for a 10-day period. The Clear-water trap peak collections were within days of the release of Dworshak Hatchery spring chinook and steelhead. The Lewiston trap exhibited major peaks for yearling chinook passage on April 3, 14, and 24 (Figure 6). Because of non-continuous sampling during the migration, 10% 50%, and 90% passage dates are not presented.

2. Lower Granite

Sampling at Lower Granite extended from April 5 through July 24, 1986. Juvenile salmonid passage dates and duration of migration are listed in Table 9 for all salmonid species present except sockeye and coho. Sockeye were present throughout the spring migration, but in numbers too low to reliably discuss dates of 10%, 50%, and 90% passage for comparison among years. Very few coho were sampled in 1984 and 1986 and none were sampled in 1985.

Yearling chinook passage peaked about two weeks earlier in 1986 than in 1984 and 1985; however, the date of median passage was only 5 to 7 days earlier in 1986 (Figure 7). Sub-yearling chinook migration peaked on June 29th in 1986, midway between the date of peaking in 1984 and 1985 (Figure 8). The sub-yearling chinook passage occurred in 1986 after the high runoff period ended.

The 1986 steelhead peak occurred one day earlier than in 1985, and 8 days earlier than in 1984; the median passage in 1986 was 4 days earlier than in both prior years (Figure 9). The steelhead migration exhibited a bimodal distribution in 1985 and 1986 with high passage indices early and late in May and a significant dip during mid-May.

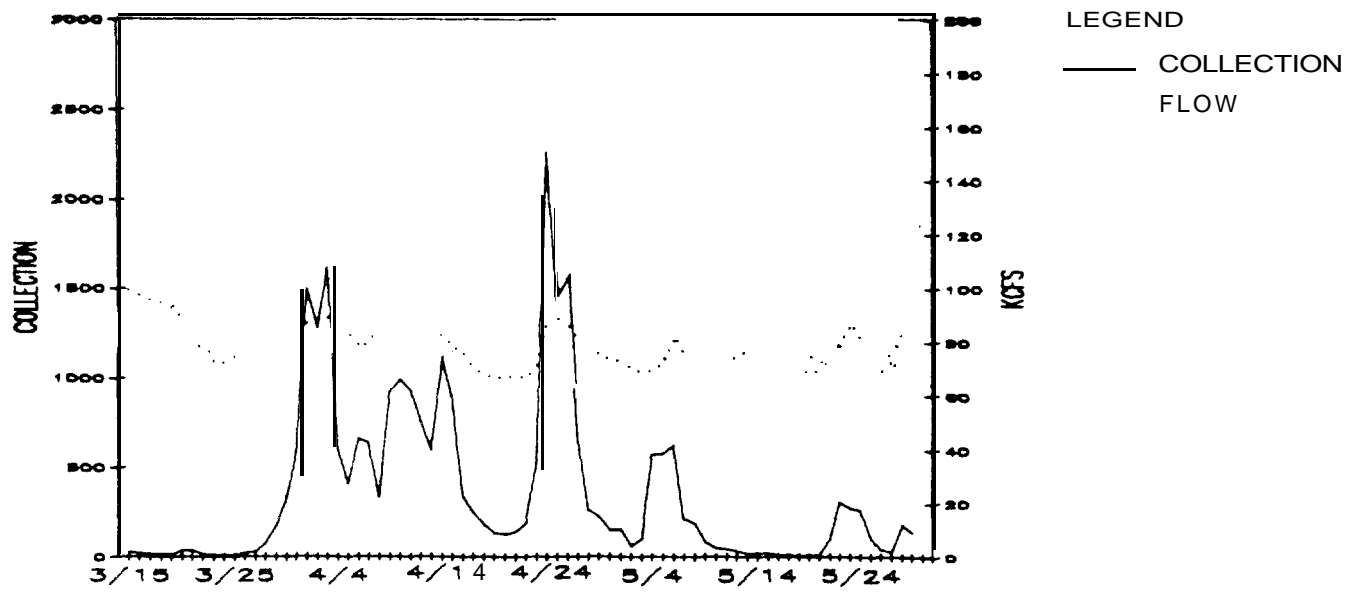


FIGURE 6 Migration Timing of Yearling Chinook at the Lewiston Trap, 1986.

TABLE 9 Juvenile Salmonid Passage Dates at Lower Granite Dam, 1984 - 1986.

	Peak	10%	50%	90%	80% Passage Duration
			<u>1986</u>		
Chinook Yearling	4/16	4/10	4/23	5/21	41 days
Chinook Sub-Year.	6/29	6/10	6/29	7/16	36 days
Steelhead	5/7	4/27	5/11	5/31	34 days
			<u>1985</u>		
Chinook Yearling	4/26	4/15	4/30	5/24	39 days
Chinook Sub-Year.	7/9	6/11	7/3	7/13	32 days
Steelhead	5/6	5/3	5/15	5/31	28 days
			<u>1984</u>		
Chinook Yearling	5 / 2	4/20	5/1	6/10	51 days
Chinook Sub-Year.	6/17	4/25	5/24	6/30	66 days
Steelhead	5/15	4/30	5/15	6/2	33 days

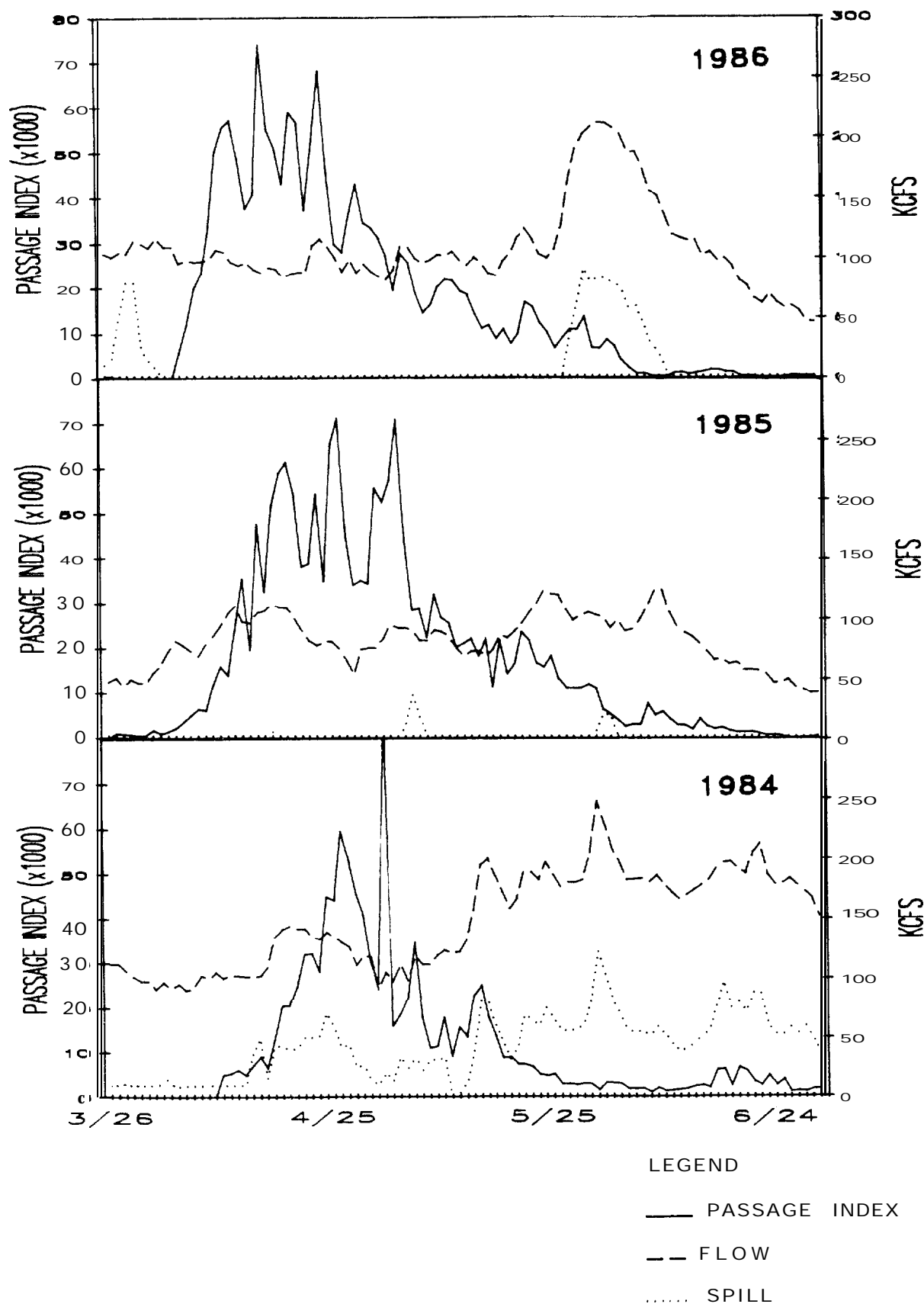


FIGURE 7 Migration Timing of Yearling Chinook at Lower Granite with associated Flow and Spill in KCFS, 1984-1986.

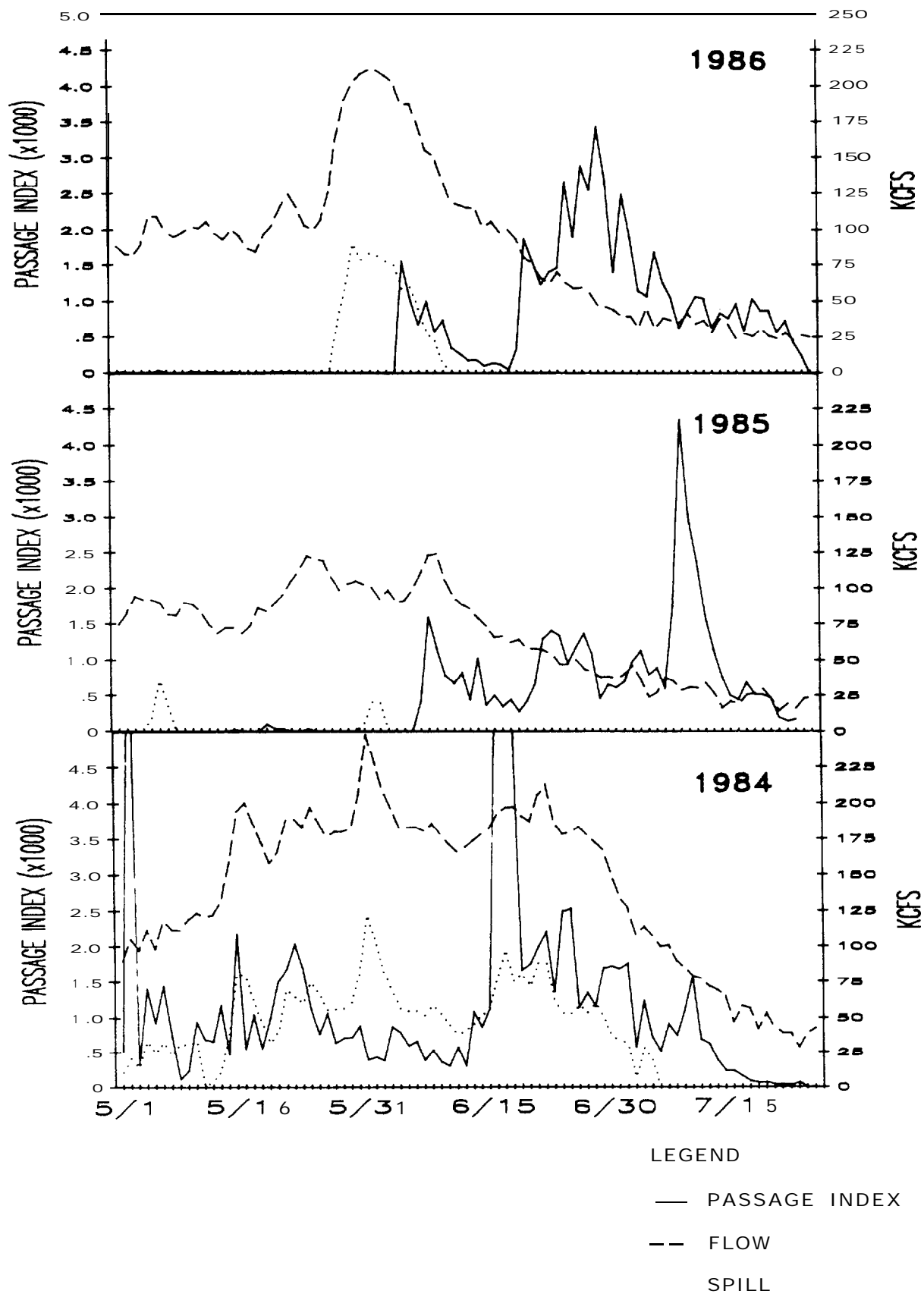


FIGURE 8 Migration Timing of Subyearling Chinook at Lower Granite with associated Flow and Spill in KCFS, 1984-1986.

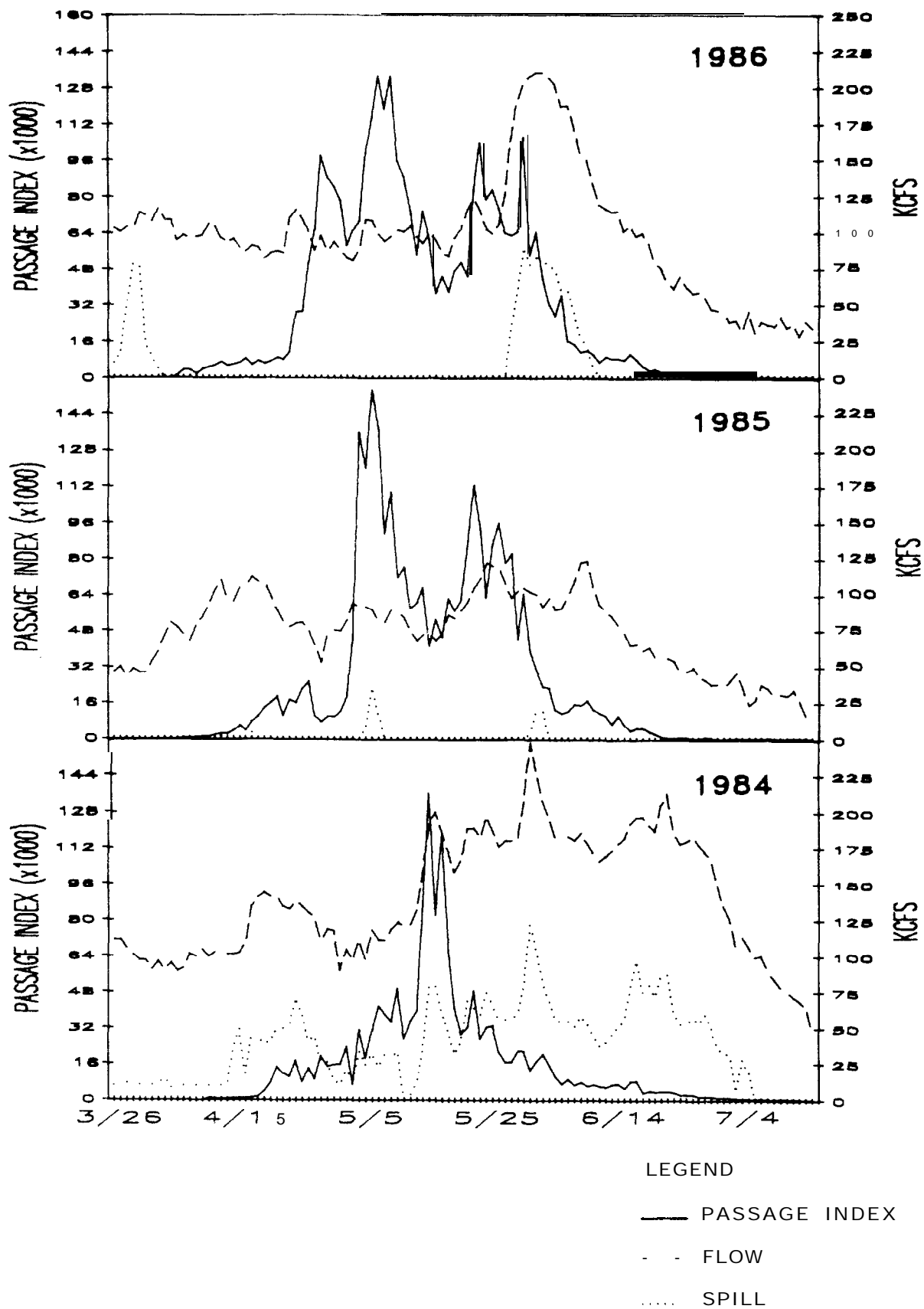


FIGURE 9 Migration Timing of Steelhead at Lower Granite with associated Flow and Spill in KCFS, 1984-1985,

3. Rock Island

Sampling of the second powerhouse bypass system at Rock Island began on April 1 and continued through August 31. Juvenile salmonid passage dates and duration of migration are shown in Table 10. The collection facility was not in full operation in 1984; therefore, no 1984 data are available for comparative purposes.

The yearling chinook migration at Rock Island was later in 1986 than 1985 (Figure 10). This was due to the later release in 1986 of spring chinook from federal hatcheries on the Wenatchee, Entiat, and Methow rivers. Even though the hatchery releases were later, the median and 90th percentile dates of passage were very similar for both years.

The sub-yearling chinook migration was earlier in 1986 (Figure 11) because the sustained high flow and spill during the first 10 days of June moved many sub-yearling wild and hatchery chinook from Wells Hatchery, the Methow, Okanogon and Wenatchee rivers quickly passed the upper projects. A comment on the June 1 daily data entry log at Rock Island read, "95% of sub-yearling chinook were less than 45mm--most of them had barely buttoned up".

The steelhead passage was very similar between 1985 and 1986 (Figure 12), whereas the coho passage occurred about one week earlier in 1986 (Figure 13). Coho passed through in a relatively short time span, shortly after their release from Rocky Reach Hatchery, which is the only coho release in the mid-Columbia.

Sockeye salmon peaked only 5 days later in 1986 than 1985, yet the date of median passage was over one month later in 1986 (Figure 14). This occurred because of a shift in dominance of the overall run from one stock to another in 1986. Sockeye from Lake Osoyoos, which peaks at Rock Island in mid to late May, dominated the run in 1986; whereas sockeye from Lake Wenatchee, which peaks at Rock Island in mid-April, dominated the run in 1985 (Peven, C.M., 1986).

TABLE 10 Juvenile Salmonid Passage Dates at Rock Island Dam, 1985 and 1986.

	<u>Peak</u>	<u>10%</u>	<u>50%</u>	<u>90%</u>	<u>80% Passage Duration</u>
	<u>1986</u>				
Chinook Yearling	5/7	4/24	5/6	5/23	29 days
Chinook Sub-Year.	6/6	6/3	6/10	7/24	51 days
Steelhead	5/21	5/11	5/20	5/29	18 days
Coho	5/21	5/16	5/21	5/28	12 days
Sockeye	4/20	4/20	5/22	6/3	44 days
	<u>1985</u>				
Chinook Yearling	4/16	4/16	5/07	5/22	36 days
Chinook Sub-Year.	6/19	6/09	7/10	8/08	60 days
Steelhead	5/23	5/11	5/22	6/02	22 days
Coho	5/24	5/23	5/28	6/05	13 days
Sockeye	4/14	4/13	4/18	5/29	46 days

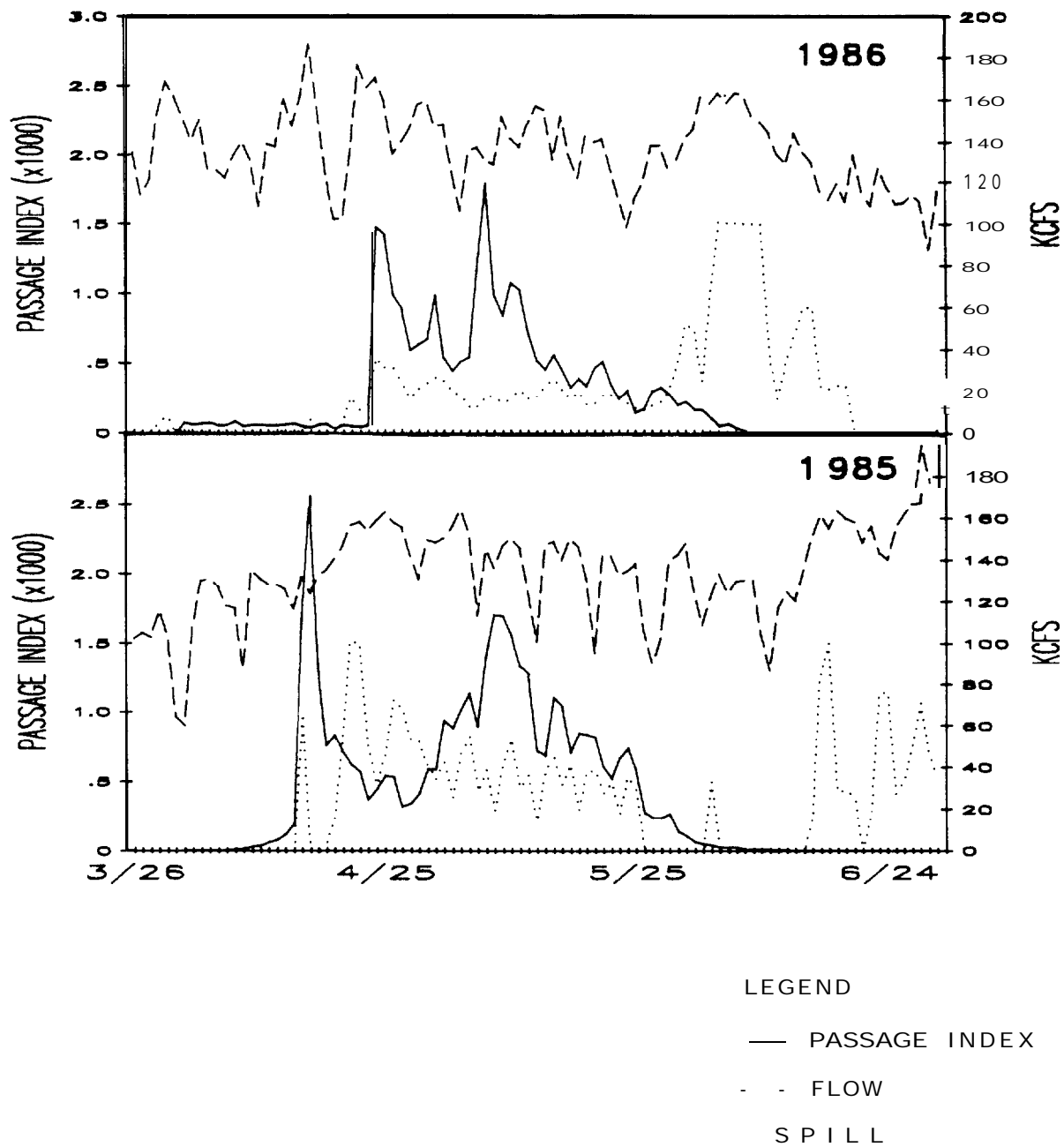


FIGURE 10 Migration Timing of Yearling Chinook at Rock Island with associated Flow and Spill in KCFS, 1984-1986.

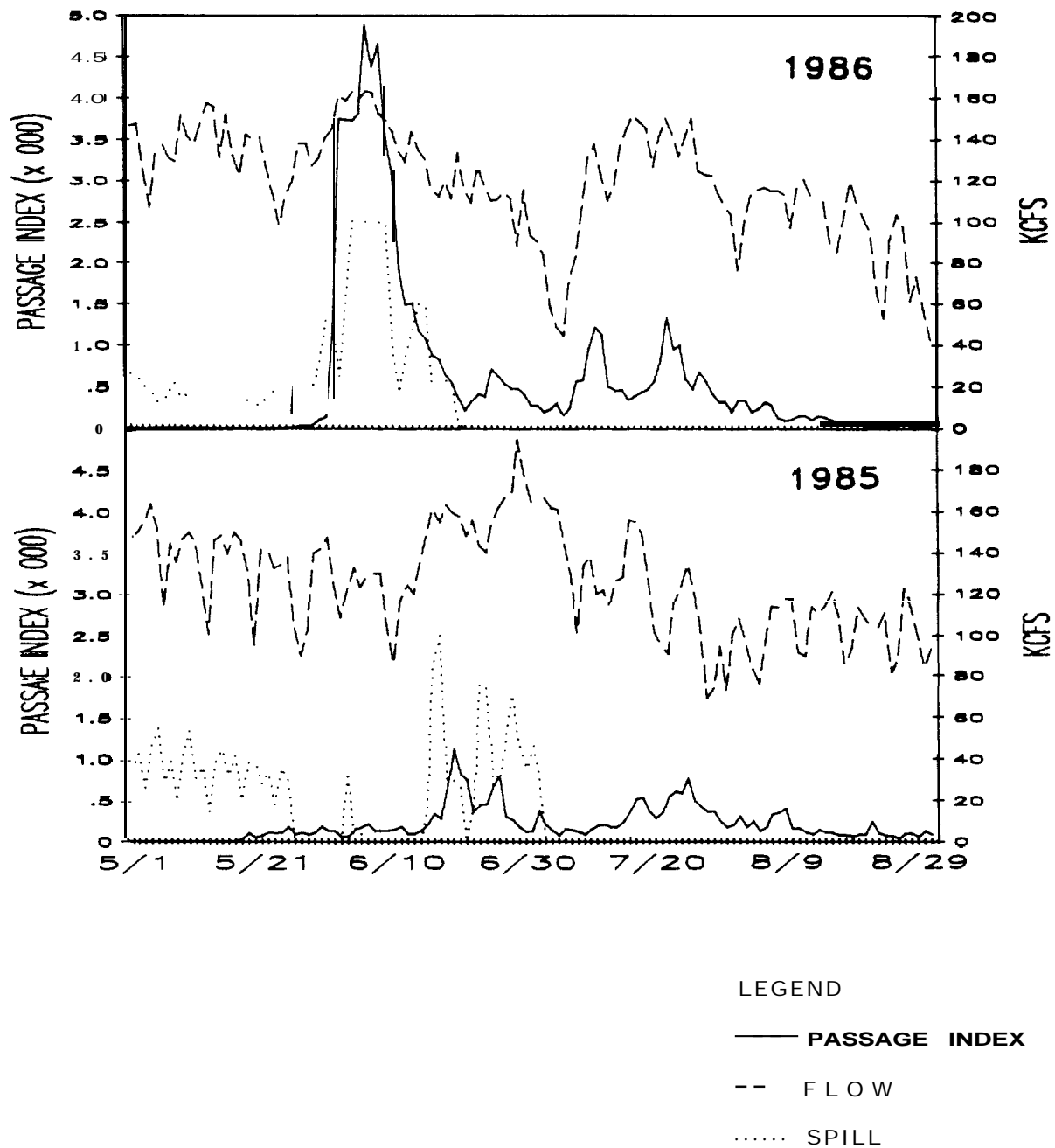


FIGURE 11 Migration Timing of Subyearling Chinook at Rock Island with associated Flow and Spill in KCFS, 1985-1986.

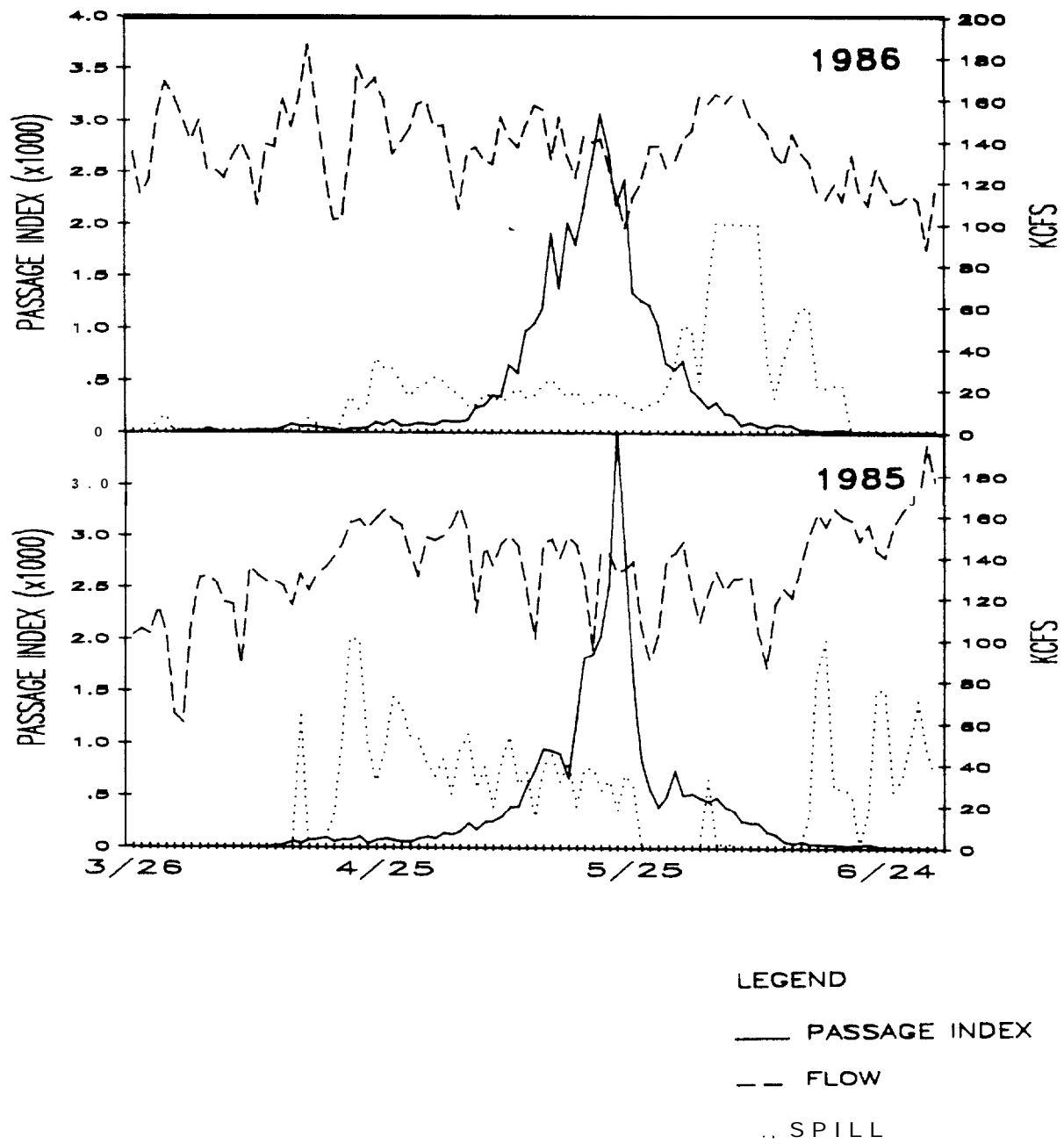


FIGURE 12 Migration Timing of Steelhead at Rock Island with associated Flow and Spill in KCFS, 1985-1986.

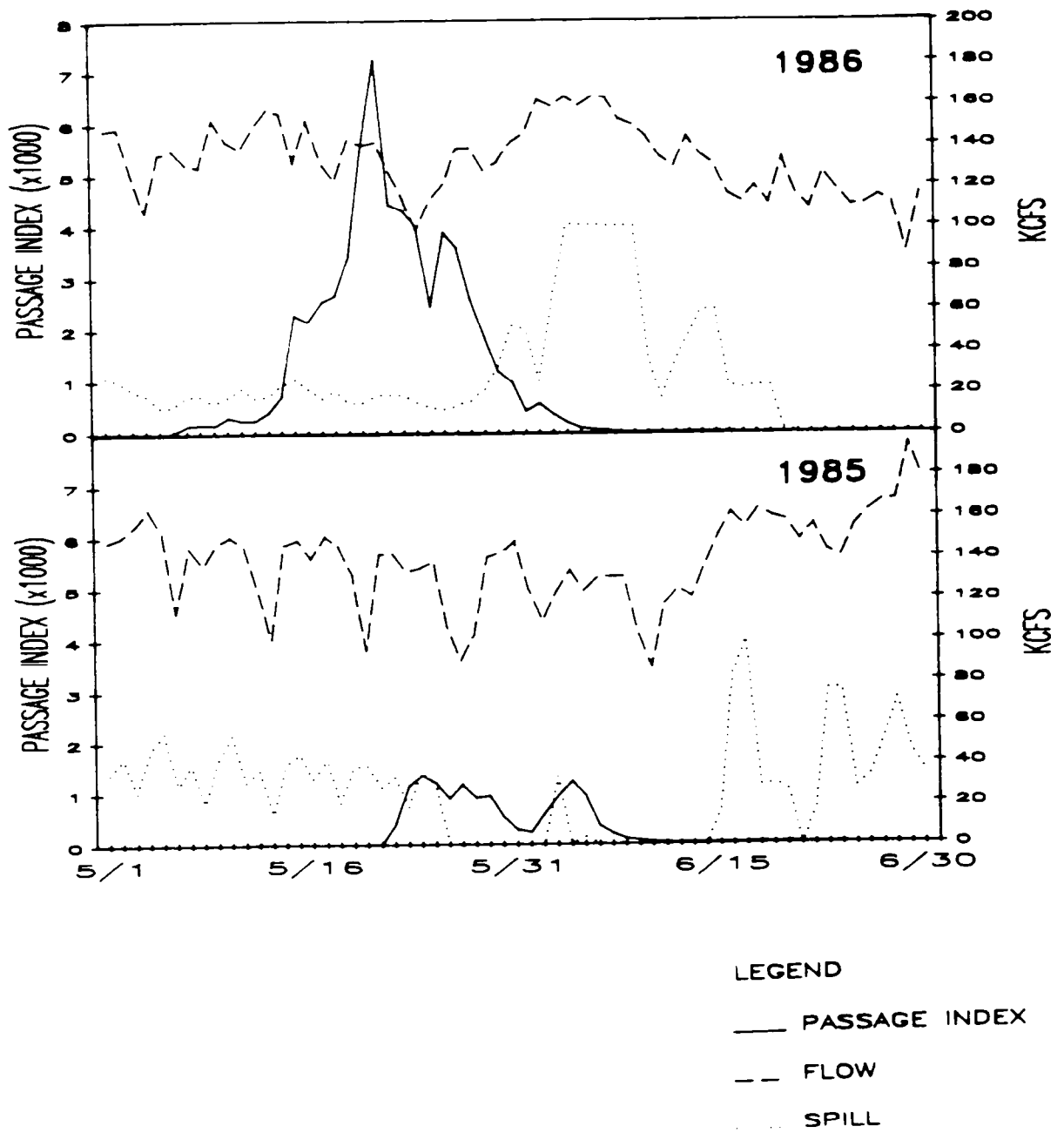


FIGURE 13 Migration Timing of Coho at Rock Island with associated Flow and Spill in KCFS, 1985-1986.

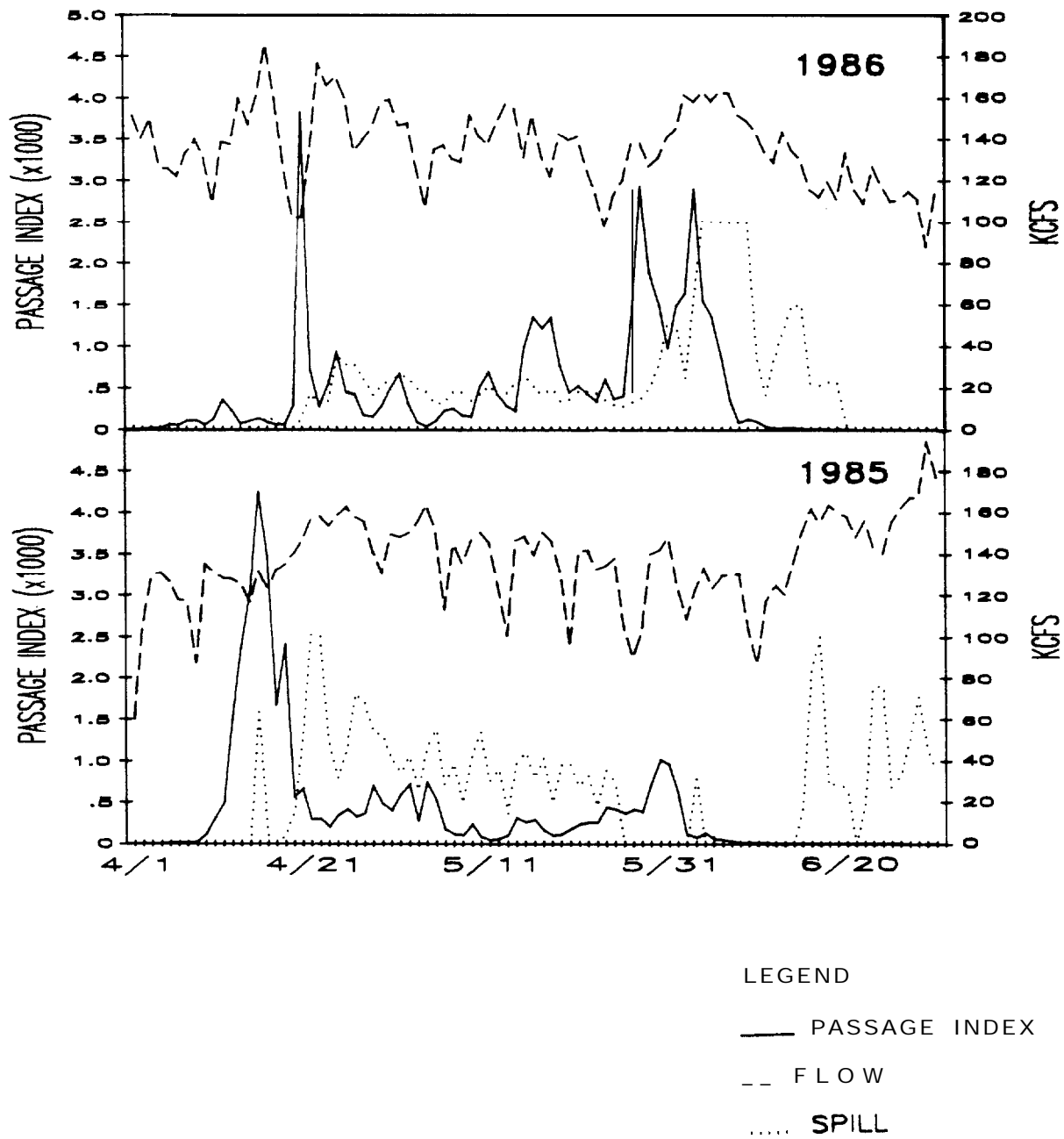


FIGURE 14 Migration Timing of Sockeye at Rock Island with associated Flow and Spill in KCFS, 1985-1986.

4. McNary Dam

Sampling at McNary Dam in 1986 began on March 26 and ended on September 26. No limited gatewell dipping was conducted in October in 1986 as had been done in 1985. Juvenile salmonid passage dates and duration of migration are listed in Table 11.

The timing of the yearling chinook migration past McNary Dam in 1985 and 1986 was similar (Figure 15). Also, each percentile of the passage distribution was only 1 day apart for both years. The shape of the yearling chinook migration curve at McNary remained markedly bimodal, with the first peak occurring on April 7 for each year, and the second and largest peak occurring on May 13 for 1984 and 1985, and on May 11 for 1986. The first peak is dominated by yearling fall chinook from Ringold and Lyons Ferry hatcheries; the second peak by spring chinook from the mid-Columbia and Snake Rivers.

The sub-yearling chinook migration began about 10 days earlier in 1986 than in 1985 due to the high flows during late May and early June, which moved hatchery and wild sub-yearlings more quickly through the mid-Columbia and lower Snake River (Figure 16). The increase in number of small sub-yearling chinook 45-55mm in length was very evident compared to recent years. Johnsen, et.al. (1986) observed that approximately 75% of the sub-yearling chinook collected at McNary between June 1 and June 17 were chinook fry, The 1986 migration curve is bimodal, with much lower passage occurring during the June 29 to July 12 period than occurred in 1985.

The 1986 steelhead migration passed McNary over a slightly shorter time span relative to the 1984 and 1985 migration (Figure 17). The coho migration occurred about two weeks earlier in 1986 than 1985, and was similar in timing to that in 1984 (Figure 18). The sockeye migration occurred about the same time each year (Figure 19).

TABLE 11 Juvenile Salmonid Passage Dates at McNary Dam, 1984 - 1986.

	Peak	10%	50%	90%	80% Passage Duration
<u>1986</u>					
Chinook Yearling	5/11	4/10	5/10	5/26	46 days
Chinook Sub-Year	7/22	6/8	7/10	8/1	54 days
Steelhead	5/23	4/29	5/18	6/3	35 days
Coho	5/23	5/20	5/28	6/8	19 days
Sockeye	5/23	5/1	5/23	6/6	36 days
<u>1985</u>					
Chinook Yearling	5/13	4/11	5/11	5/27	46 days
Chinook Sub-Year	7/13	6/17	7/09	7/24	37 days
Steelhead	5/26	4/25	5/22	6/06	42 days
Coho	6/11	6/03	6/11	6/13	10 days
Sockeye	5/26	4/30	5/20	6/08	39 days
<u>1984</u>					
Chinook Yearling	5/21	4/23	5/11	5/25	32 days
Chinook Sub-Year	7/17	6/07	7/15	8/11	70 days
Steelhead	5/7	4/27	5/19	6/05	39 days
Coho	5/25	5/19	5/25	6/04	16 days
Sockeye	5/07	5/02	5/16	6/13	42 days

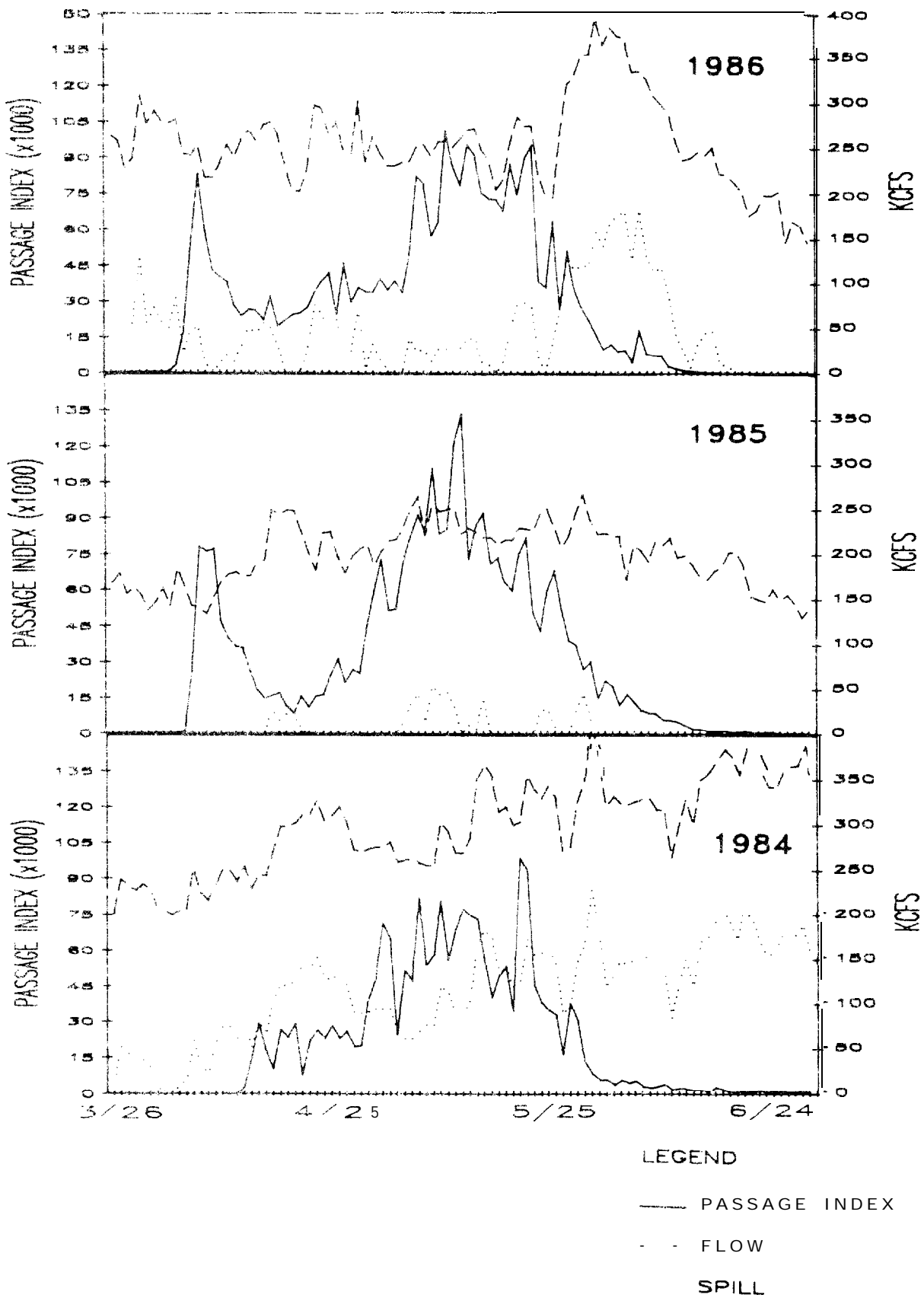


FIGURE 15 Migration Timing of Yearling Chinook at McNary with associated Flow and Spill in KCFS, 1984-1986.

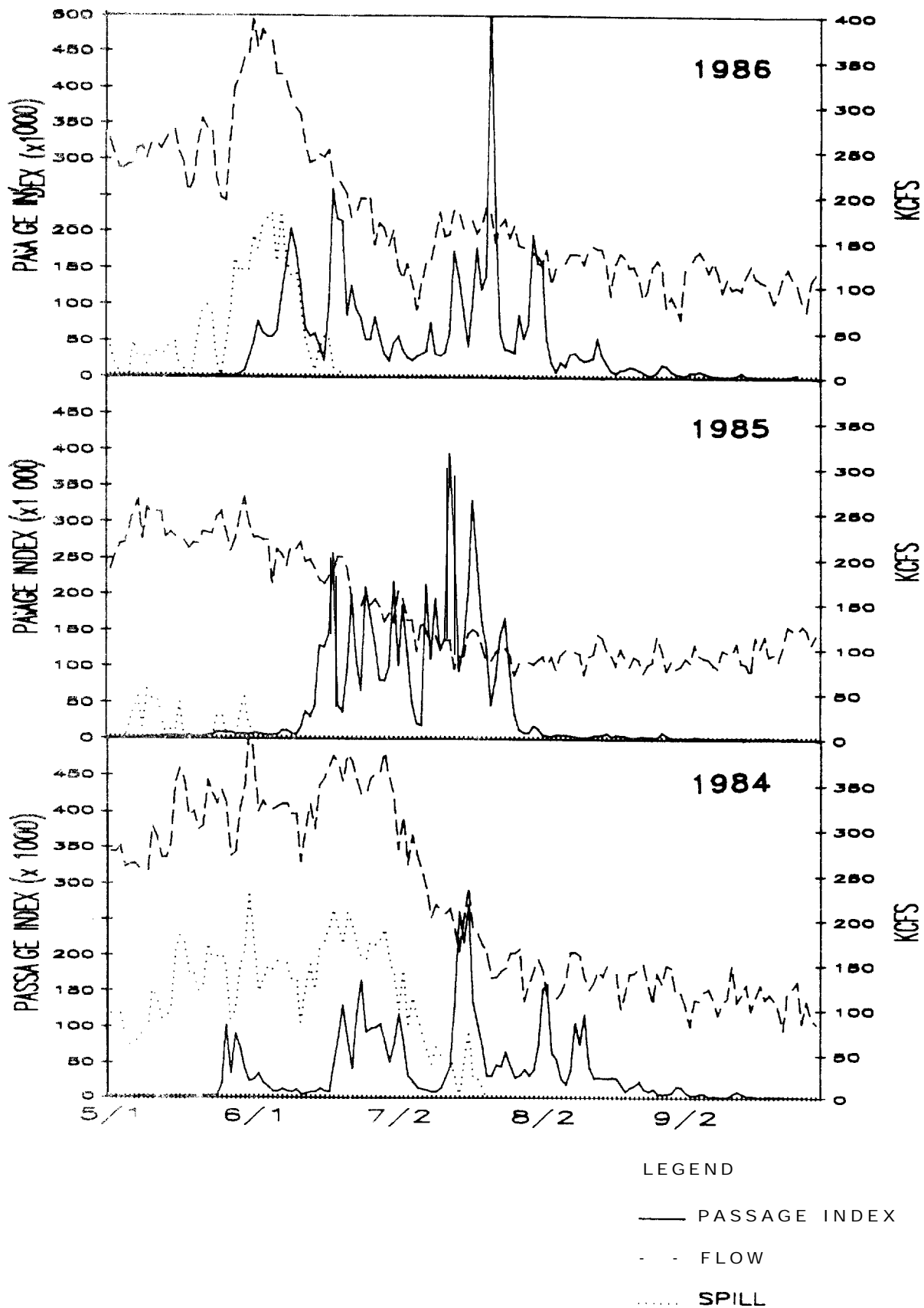


FIGURE 16 Migration Timing of Subyearling Chlnook at McNary with associated Flow and Spill in KCFS, 1984-1986.

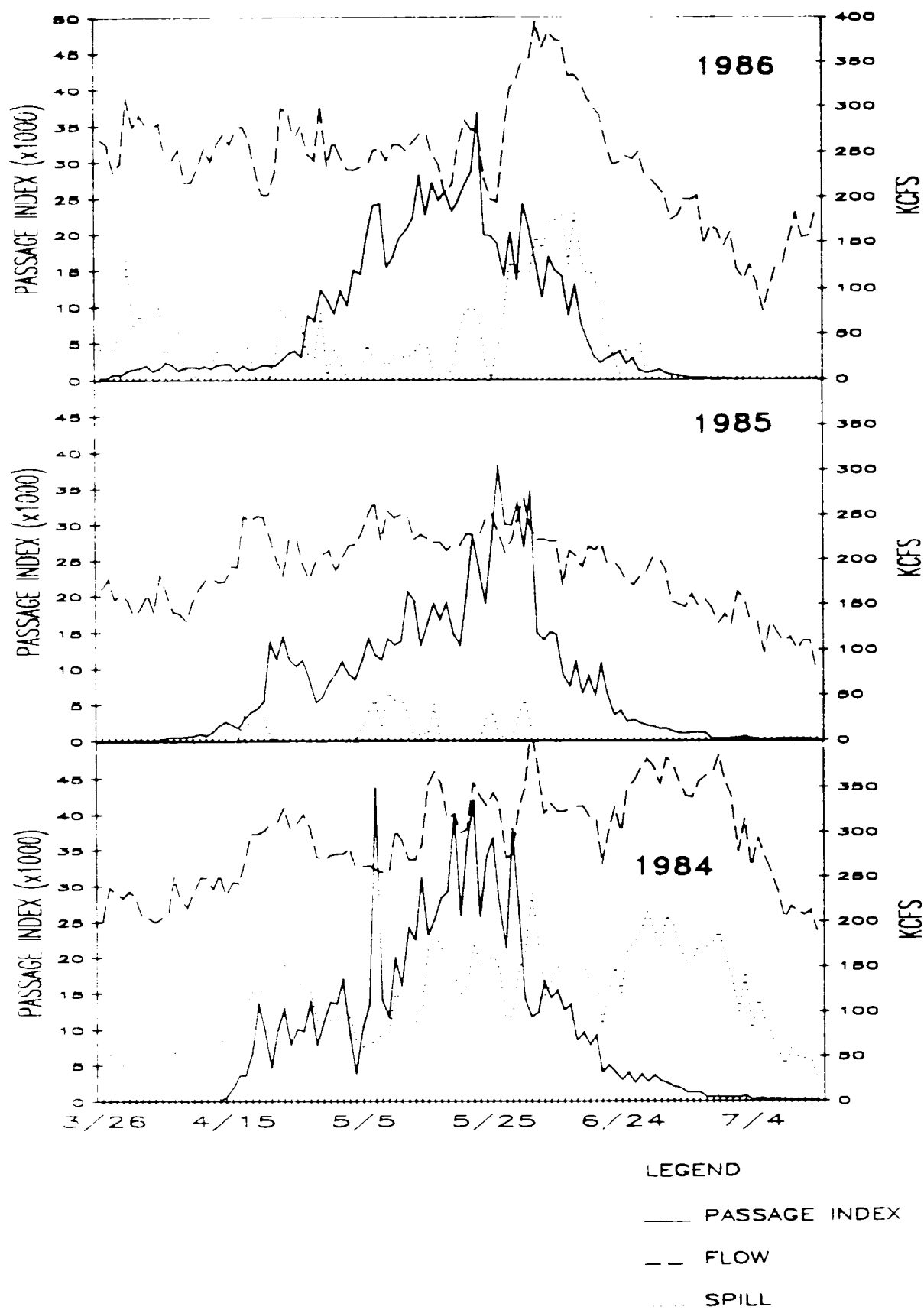


FIGURE 17 Migration Timing of Steelhead at McNary with associated Flow and Spill in KCFS, 1984-1986.

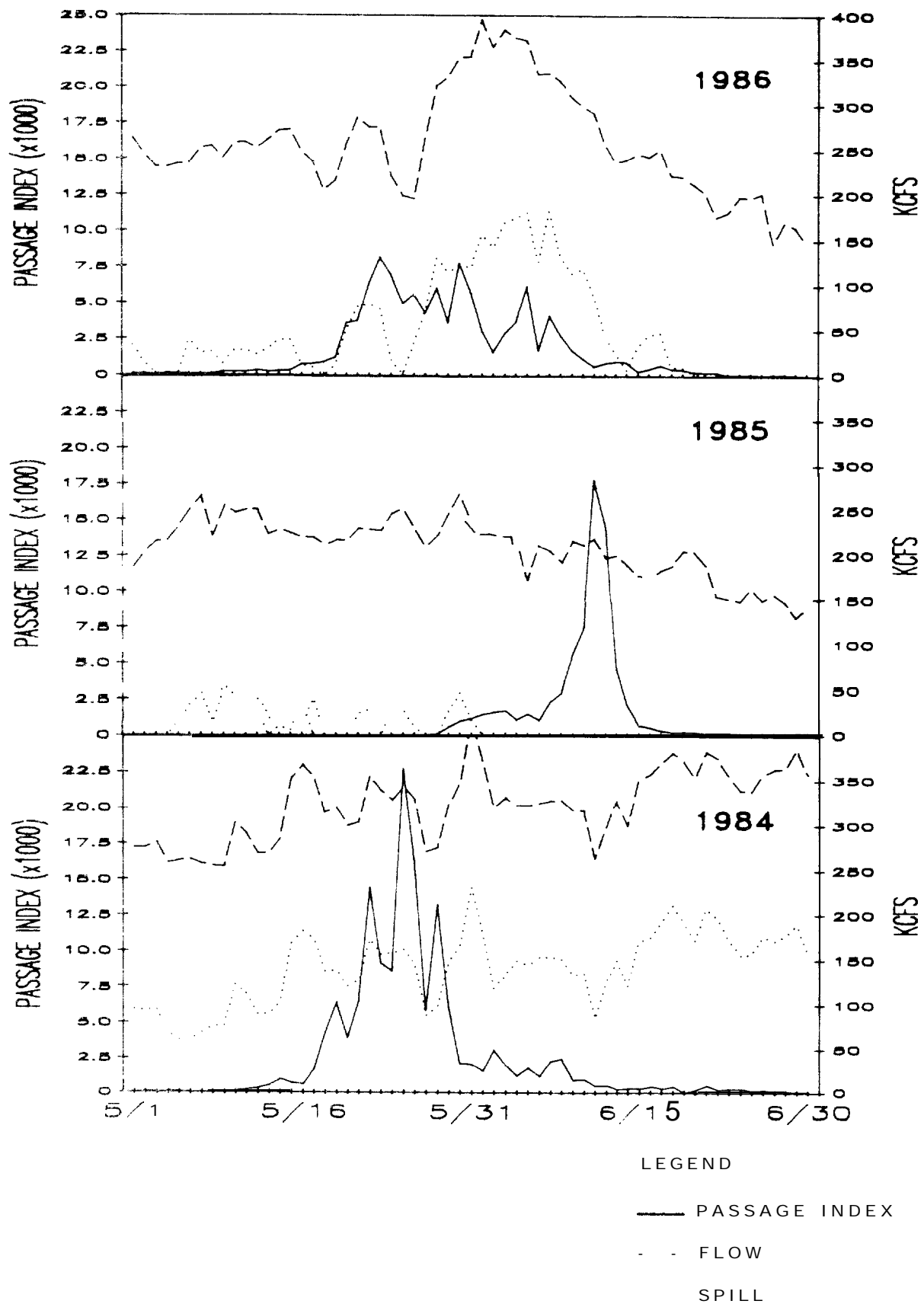


FIGURE 18 Migration Timing of Coho at McNary with associated Flow and Spill in KCFS, 1984-1986.

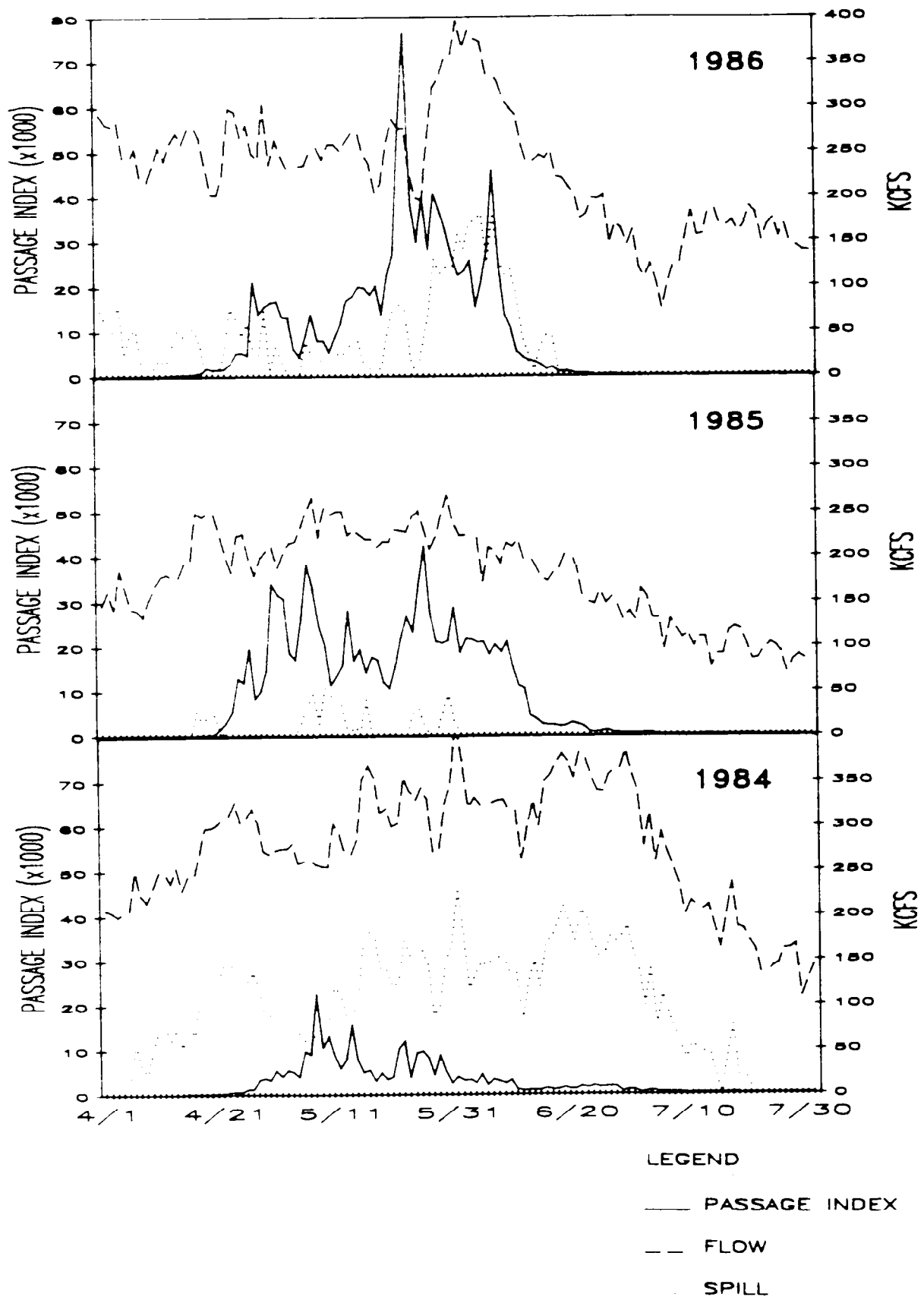


FIGURE 19 Migration Timing of Sockeye at McNary with associated Flow and Spill in KCFS, 1984-1986.

5. John Day Dam

Sampling at John Day Dam began on March 28 and ended on October 30.

Juvenile salmonid passage dates and duration of migration for 1986 are shown in Table 12. The migration timing and duration of period of 80% passage was very similar at John Day and McNary for yearling chinook, steelhead, coho and sockeye, indicating that these species do not reside long in John Day pool during their downstream migration. For sub-yearling chinook, 10% passage was achieved on the same date at both projects, and 90% passage was over 3 weeks later at John Day. This greater duration of the middle 80% passage at John Day is indicative of a longer residence period of sub-yearling chinook in John Day pool as compared to the other species.

TABLE 12 Juvenile salmonid passage dates at John Day for 1986.

	<u>Peak</u>	<u>10%</u>	<u>50%</u>	<u>90%</u>	<u>80% Passage Duration</u>
Chinook Yearling	5/21	4/18	5/14	5/28	40 days
Chinook Sub-Yrlg	8/12	6/8	7/22	8/24	77 days
Steelhead	5/30	4/25	5/18	6/3	39 days
Coho	5/29	5/22	5/29	6/7	16 days
Sockeye	5/25	5/3	5/23	6/4	32 days

The yearling chinook migration timing was earlier in 1986 than the previous two years (Figure 20). From June 4 to 20, chinook fry accounted for about 60% of the sub-yearling chinook collection (Johnsen, et.al., 1986). High flows early in June apparently were moving many wild fall chinook quickly through John Day pool.

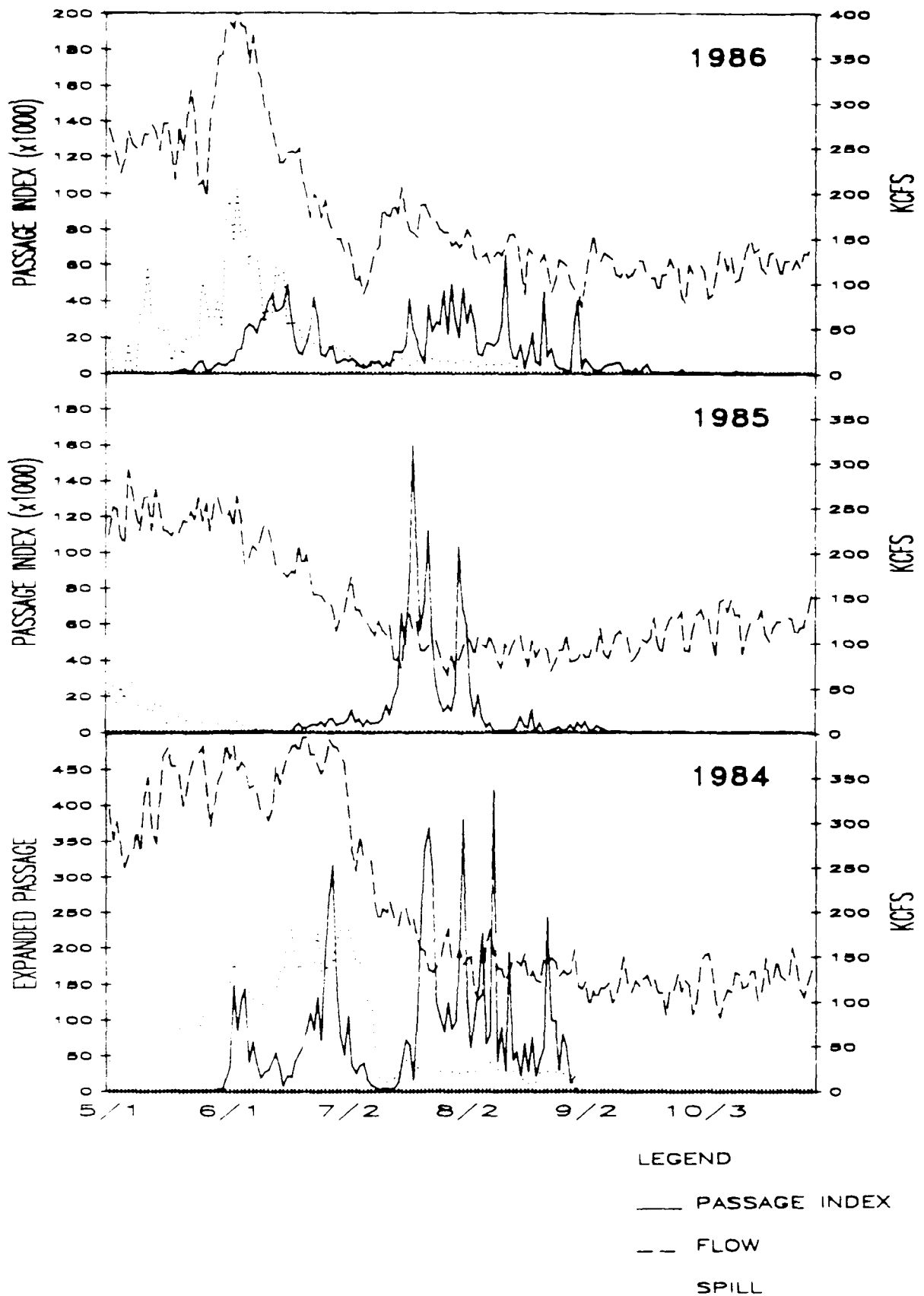


FIGURE 20 Migration Timing of Subyearling Chinook at John Day with associated Flow and Spill in KCFS, 1984-1986.

D. Travel Time of Marked Groups

Marked groups of yearling and sub-yearling chinook and steelhead are released in the Snake and mid-Columbia rivers under the SMP to provide information on smolt travel time and speed. The same groups are used each year so that comparable data is collected for assessing travel time versus flow relationships over a period of years. For this purpose, travel time is annually indexed between Lower Granite and McNary, Rock Island and McNary, and between McNary and John Day dams. In addition, travel time estimates for marked hatchery and in-river groups from other research programs are presented for comparison to the SMP groups.

1. Snake River

Travel time was computed in the Snake River drainage from release site to Lower Granite and McNary dams, within the index reach from Lower Granite to McNary, and between other recovery sites when adequate recovery numbers were available. Within the index reach, Lower Granite, Little Goose, and McNary dams have juvenile salmonids bypass collection facilities and a transportation program aimed at steelhead and sub-yearling chinook. Therefore, few FPC marked steelhead are collected below Little Goose Dam. The other two projects within the index reach, Lower Monumental and Ice Harbor dams, have spill programs to assist migrating salmonids passed these projects since they have no bypass system.

a. Spring/Summer Chinook

Travel time of the five SMP groups from release sites to Lower Granite Dam ranged from 14 to 37 days, and migration speed ranged from 3.8 to 12.6 miles per day (Table A). The average speed was 8.7 miles/day for the 5 groups. Of these groups, Dworshak Hatchery spring chinook exhibited the slowest migration speed of 3.8 miles/day. The other 4 groups had an average speed of 9.9 miles/day.

A travel time index was obtained between Lower Granite and McNary Dams for

Table A. YEARLING CHINOOK TRAVEL TIME FROM RELEASE SITE IN THE SNAKE RIVER DRAINAGE TO LOWER GRANITE

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDEX	MEDIAN		-----50% PASSAGE-----		AVE. SPEED (MILES/DAY)	DISTANCE TRAVELED
				RELEASE DATE	ARRIVAL DATE	DAYS OF TRAVEL	RIVER FLOW^		
RD-Y-1	SAWTOOTH HATCHERY	35,851	2,270	17-Mar	23-Apr	37	97.93	12.6	465.2
RD-Y-3	S.F.SALMON RIVER	43,487	6,109	27-Mar	02-May	36	89.26	7.9	284.5
LD-Y-1	RAPID RIVER	44,692	10,608	05-Apr	19-Apr	14	88.38	12.4	173.6
LD-Y-3	HELLS CANYON	44,754	9,908	26-Mar	16-Apr	21	91.84	6.6	139.5
RA-Y-2	DWORSHAK HATCHERY	40,675	4,733	02-Apr	21-Apr	19	92.25	3.8	73.1

^ River flow is the average flow for 7 days around the 50% arrival date at Lower Granite.

Table B. YEARLING CHINOOK INDEX TRAVEL TIME FROM LOWER GRANITE TO McNARY (INDEX DISTANCE IS 139.8 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			LGR	MCN	LGR	MCN			
RD-Y-1	SAWTOOTH HATCHERY	35,851	2,270	750	23-Apr	02-May	9	93.23	15.5
RD-Y-3	E.F.SALMON RIVER	43,487	6,109	2,064	02-May	15-May	13	99.33	10.8
LD-Y-1	RAPID RIVER	44,692	10,608	3,260	19-Apr	04-May	15	93.23	9.3
LD-Y-3	HELLS CANYON	44,754	9,908	3,475	16-Apr	28-Apr	12	100.75	11.7
RA-Y-2	DWORSHAK HATCHERY	40,675	4,733	3,997	21-Apr	11-May	20	96.59	7.0

^ River flow is the average flow for 7 days around the estimated 50% arrival date at Ice Harbor.

Table C. YEARLING AND SUBYEARLING CHINOOK TRAVEL TIME FROM RELEASE SITE IN THE SNAKE RIVER DRAINAGE TO McNARY

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDEX	MEDIAN	-----50% PASSAGE-----		RIVER FLOW ^	AVE SPEED (MILES/DAY)	DISTANCE TRAVELED
				RELEASE DATE	ARRIVAL DATE	DAYS OF TRAVEL			
YEARLING CHINOOK									
RD-Y-1	SAWTOOTH HATCHERY	35,851	750	17-Mar	02-May	46	95.91	13.2	605
RD-Y-3	S.F.SALMON RIVER	43,487	2,064	27-Mar	15-May	49	100.51	8.7	424.3
LD-Y-1	RAPID RIVER	44,692	3,260	05-Apr	04-May	29	89.43	10.8	313.4
LD-Y-3	HELLS CANYON	44,754	3,475	26-Mar	28-Apr	33	100.21	8.5	279.3
RA-Y-2	DWORSHAK HATCHERY	40,675	3,997	02-Apr	11-May	39	92.55	5.5	212.9
RA-7K-1	LYONS FERRY HATCHERY	40,168	15,311	02-Apr	27-Apr	25	96.21	3.7	91.4
RA-A,F,PI,R*	BELOW LOWER GRANITE	54,000	8,886	27-Mar	05-May	39	100.21	3.6	11.8
LA-A,F,PI,R*	BELOW LOWER GRANITE	54,000	8,108	30-Mar	01-May	32	95.16	4.4	139.8
RD-A,F,PI,R*	BELOW LOWER GRANITE	54,000	8,421	02-Apr	02-May	30	100.21	4.7	139.8
LA-P-1*	BELOW LITTLE GOOSE	5,000	1,970	10-Apr	22-Apr	12	91.43	8.4	101
LA-P-2*	BELOW LITTLE GOOSE	5,000	3,524	13-Apr	27-Apr	14	95.16	7.2	101
LA-P-3*	BELOW LITTLE GOOSE	5,104	1,875	16-Apr	28-Apr	12	100.21	8.4	101
LA-W-1*	BELOW LITTLE GOOSE	5,000	2,318	22-Apr	03-May	11	95.91	9.2	101
LA-W-2*	BELOW LITTLE GOOSE	5,000	1,809	25-Apr	06-May	11	89.06	9.2	101
LA-W-3**	BELOW LITTLE GOOSE	5,000	2,119	30-Apr	10-May	10	96.59	10.1	101
SUB-YEARLING CHINOOK									
RA-T-3	LYONS FERRY HATCHERY	81,003	19,570	10-Jun	26-Jun	16	94.64	5.7	91.4

^ River Flow is the average flow for 7 days around the estimated 50% passage date at Ice Harbor.

* Non-SMP marked groups.

these 5 groups of yearling chinook (Table B). The travel time index ranged from 9 to 20 days and averaged 13.8 days. The migration speed ranged from 7.0 miles per day to 15.5 miles/day and averaged 10.1 miles/day. The Dworshak group exhibited the slowest migration speed in this reach also.

The overall travel time of these groups from release sites to McNary Dam was from 29 to 49 days (Table C). The migrations speed ranged from 5.5 to 13.2 miles/day and averaged 9.3 miles/day.

Four of the five SMP yearling chinook salmon index groups were recaptured in adequate numbers at Lewiston or Clearwater trap and Lower Monumental to allow calculation of travel time in additional segments between Lewiston, Idaho and John Day Dam. Travel time was calculated from Lewiston, Idaho to Lower Granite Dam, Lower Granite to Lower Monumental Dam, Lower Monumental to McNary Dam, and McNary to John Day Dam (an index reach). Migration speed for yearling chinook increased in each of these reaches, averaging approximately 2.6 miles/day, 8.0 miles/day, 10.8 miles/day, and 25.5 miles/day, respectively, as the fish moved down the river (Table D).

These speeds agree with the rates observed for other non-SMP in-river and hatchery groups. In-river fish marked at Lewiston trap traveled to Lower Granite Dam at an average speed of 2.5 miles/day (Table E), which is very close to the 2.6 miles/day average of the SMP hatchery groups. In-river fish released as transportation study controls below Little Goose Dam and hatchery fish releases from the Lower Granite Dam survival studies traveled at an average speed of 10.8 miles/day, respectively, between Lower Monumental and McNary dams (Table G), which is identical to that of the five SMP hatchery index groups. The similarities in speeds between SMP and non-SMP groups in the McNary to John Day reach are discussed later under Lower Columbia.

TABLE D Travel time of yearling chinook in subsections of the Snake River and lower Columbia between Lewiston, Idaho and John Day Dam^a.

<u>Reach</u>		<u>Rapid River H.</u>		<u>McCall H.</u>	<u>Dworshak H.</u>	<u>AVG^b</u>
		<u>Rapid River</u>	<u>Hells Canyon</u>	<u>SF Salmon</u>	<u>NF Clearwater</u>	
		<u>LD-Y-1</u>	<u>LD-Y-3</u>	<u>RD-Y-3</u>	<u>RA-Y-2</u>	
LEW--LGR	days	9	13	9	18	12.3
(32.2 miles)	speed	3.6	2.5	3.6	1.8	2.6
LGR--LMN	days	8	7	5	13	8.3
(66.2 miles)	speed	8.3	9.5	13.2	5.1	8.0
LMN--MCN	days	7	5	8	7	6.8
(73.6 miles)	speed	10.5	14.7	9.2	10.5	10.8
MCN--JDA	days	2	4	N/A	**	3.0
(76.4 miles)	speed	38.2	19.1	--	**	25.5

^a Data compiled from Tables E, F, G, and S.

^b Average speed calculated as average travel time in days divided into reach distance.

** Poor recovery distribution--bimodal with median in trough between modes resulting in unreliable travel time estimate of one day and speed of migration of 76.4 miles/day. These data are excluded from average column.

Table E. YEARLING CHINOOK TRAVEL TIME FROM LEWISTON TO LOWER GRANITE
(INDEX DISTANCE IS 31.2 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			LEW	LGR	LEW	LGR			
RD-Y-3	S. F. SALMON RIVER	43,487	189	6,109	23-Apr	06-May	9	89.26	3.5
LD-Y-1	RAPID RIVER	44,692	542	10,608	10-Apr	19-Apr	9	88.38	3.5
LD-Y-3	HELLS CANYON	44,754	370	9,908	03-Apr	16-Apr	13	91.84	2.4
RD-K-1*	BELOW LEWISTON TRAP	2,793	N/A	581	02-Apr	15-Apr	13	94.23	2.4
RD-K-2*	BELOW LEWISTON TRAP	1,596	N/A	606	06-Apr	23-Apr	17	97.93	1.6
RD-K-3'	BELOW LEWISTON TRAP	2,743	N/A	463	11-Apr	22-Apr	11	95.03	2.6
RA-K-2*	BELOW LEWISTON TRAP	2,421	N/A	348	27-Apr	06-May	9	95.65	3.5

* Non-SMP marked groups. Median date of release was assigned for Lewiston trap.

^ River Flow is the average flow for 7 days around the 50% passage date at Lower Granite.

Table F. YEARLING CHINOOK TRAVEL TIME FROM LOWER GRANITE TO LOWER MONUMENTAL
(INDEX DISTANCE IS 66.2 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			LGR	LMN	LGR	LMN			
RD-Y-3	S. F. SALMON RIVER	43,487	6,109	189	02-May	07-May	5	97.79	13.2
LD-Y-1	RAPID RIVER	44,692	10,608	542	19-Apr	27-Apr	8	103.03	8.3
LD-Y-3	HELLS CANYON	44,754	9,908	370	16-Apr	23-Apr	7	97.63	9.5
RA-Y-2	DWORSK HATCHERY	40,675	4,733	546	21-Apr	04-May	13	93.84	5.1

^ River Flow is the average flow for 7 days around the 50% passage date at Lower Monumental.

Table G. YEARLING CHINOOK INDEX TRAVEL TIME FROM LOWER MONUMENTAL TO MCNARY
(INDEX DISTANCE IS 73.6 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			LMN	MCN	LMN	MCN			
RD-Y-3	S. F. SALMON RIVER	43,487	189	2,064	01-May	15-May	8	100.51	9.2
LD-Y-1	RAPID RIVER	41,692	542	3,260	27-Apr	01-May	7	89.43	10.5
LD-Y-3	HELLS CANYON	44,754	370	3,475	23-Apr	28-Apr	5	101.01	14.7
RA-Y-2	DWORSK HATCHERY	40,675	546	3,997	01-May	11-May	7	101.03	10.5
RA-A, F. PI, R*	LOWER GRANITE DAM	54,000	997	8,886	27-Apr	05-May	8	89.43	9.2
LA-A, F. PI, R*	LOWER GRANITE DAM	54,000	862	8,108	26-Apr	01-May	5	95.91	14.7
RD-A, F. PI, R*	LOWER GRANITE DAM	54,000	1,029	8,421	26-Apr	02-May	6	95.91	12.3
LA-P-1*	BELOW LITTLE GOOSE	5,000	418	1,970	15-Apr	22-Apr	7	90.15	10.5
LA-P-2*	BELOW LITTLE GOOSE	5,000	615	3,524	19-Apr	27-Apr	8	96.56	9.2
LA-P-3*	BELOW LITTLE GOOSE	5,104	216	1,875	21-Apr	28-Apr	7	100.75	10.5
LA-W-1*	BELOW LITTLE GOOSE	5,000	308	2,318	26-Apr	03-May	7	93.23	10.5
LA-W-2*	BELOW LITTLE GOOSE	5,000	244	1,809	29-Apr	06-May	7	89.68	10.5
LA-W-3*	BELOW LITTLE GOOSE	5,000	344	2,119	04-May	10-May	6	96.90	12.3
RA-7K-1	LYONS FERRY HATCHERY	40,168	1,248	15,311	16-Apr	27-Apr	11	91.33	6.7

* Non-SMP marked groups.

^ River Flow is the average flow for 7 days around the estimated 50% passage date at Ice Harbor.

b. Yearling and Sub-Yearling Fall Chinook

A release of marked yearling fall chinook from Lyons Ferry Hatchery was slow to move out of Lower Monumental pool. Although the first of the migration passed Lower Monumental Dam in about two days, the overall migration was slow, resulting in the median passage occurring two weeks later. Travel speed from Lower Monumental to McNary Dam increased to about 6.7 miles/day (Table G).

A release of marked sub-yearling chinook salmon from Lyons Ferry Hatchery traveled to McNary in 16 days based on the median passage at McNary (Table C) with a migration speed of 5.7 miles/day. No travel time estimate between Lower Monumental and McNary dams was made since the dates of 25%, 50%, and 75% passage at Lower Monumental were later than those dates at McNary.

c. Steelhead

Travel time for the four SMP marked groups from release site to Lower Granite Dam ranged from 10 to 50 days, depending on distance travelled, and migration speeds ranged from 5.7 to 13.9 miles/day (Table H). Pooled replicate releases made at three additional sites for non-SMP hatchery groups show travel times ranging from 23 to 33 days and speeds ranging from 3.2 to 6.7 miles/day. The average speed of the SMP groups was 9.1 miles/day, about twice the speed of the non-SMP hatchery groups whose average speed was 4.6 miles/day.

Since the majority of the steelhead migration from the upper Snake River is transported at Lower Granite and Little Goose dams, very few upper Snake River hatchery marked steelhead are recovered at Lower Monumental, McNary, and John Day dams. Therefore, only Grande Ronde and Dworshak groups are shown in Table I for travel time in the index reach from Lower Granite to McNary Dam. Index travel time ranged from 7 to 9 days and averaged 8 days. Migration speeds in the index reach ranged from 15.5 to 20 miles/day and averaged 17.5 miles/day, which is 73 percent faster than yearling chinook in this reach.

Table H. STEELHEAD TRAVEL TIME FROM RELEASE SITE TO LOWER GRANITE

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDEX	MEDIAN	-----50% PASSAGE-----		RIVER FLOW ^	AVE. SPEED (MILES/DAY)	DISTANCE TRAVELED
				RELEASE DATE	ARRIVAL DATE	DAYS OF TRAVEL			
LD-T-2	SAWTOOTH HATCHERY	52,300	4,260	09-Apr	28-May	49	146.33	9.5	465.2
LD-T-4	E.F.SALMON RIVER	51,325	1,619	08-Apr	28-May	50	146.33	5.7	284.5
LA,RA-J-1,3*	WALLOWA HATCHERY	59,734	5,067	02-May	29-May	27	162.05	6.7	182
RD-T-2	HELLS CANYON	51,328	5,165	27-Apr	07-May	10	98.24	13.9	139.5
RA-J-2,4*	LITTLE SHEEP CREEK	26,457	2,539	27-Apr	30-May	33	178.05	3.2	107
RA-IJ-1,3,4*	GRANDE RONDE RIVER	60,000	14,619	27-Apr	20-May	23	102.81	3.9	90.2
RD-T-4	DWORSHAK HATCHERY	35,025	7,606	07-May	17-May	10	93.26	7.3	73.1

^ River flow is the average flow for 7 days around the 50% arrival date at Lower Granite.

* Non-SMP marked groups.

Table I. STEELHEAD INDEX TRAVEL TIME FROM LOWER GRANITE TO MCNARY
(INDEX DISTANCE IS 139.8 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			LGR	MCN	LGR	MCN			
RA-IJ-1,3,4*	GRANDE RONDE RIVER	60,000	14,619	1,264	20-May	27-May	7	114.81	20.0
RD-T-4	DWORSHAK HATCHERY	35,025	7,606	547	17-May	26-May	9	109.99	15.5

^ River flow is the average flow for 7 days around the estimated 50% arrival date at Ice Harbor.

* Non-SMP marked groups.

Travel time and speed of migration from release site to McNary Dam are shown in Table J. Lyons Ferry Hatchery groups released at the same location exhibited very similar travel times, never differing by more than 4 days. The speed of Lyons Ferry hatchery releases in the Tucannon River averaged 5.9 miles/day, below Little Goose Dam averaged 5.1 miles/day, on-site averaged 4.4 miles/day and below Ice Harbor averaged 3.8 miles/day. The speed of in-river steelhead released below Little Goose Dam as part of the COE transportation studies averaged 15.2 miles/day. This is approximately three times faster than the Lyons Ferry Hatchery fish released in the same vicinity. The in-river groups consist of fish from upper Snake River hatcheries or wild stocks, which have been already actively migrating for a period of time before they were marked and released. For in-river fish released over slightly more than a month period, a trend toward faster travel times was apparent with later release groups.

The Lyons Ferry releases into the Tucannon River (IK brand) approach the migration speeds of the in-river fish by the time they are migrating between Lower Monumental and McNary dams (Table K). The remaining Lyons Ferry releases below Little Goose (average 4.9 miles/day) and on-site (average 5.2 miles/day) are still migrating at about one-third the speed of in-river fish (average 17.2 miles/day) between Lower Monumental and McNary dams. By the time these groups were migrating through John Day pool, they were traveling at speeds comparable to the in-river fish.

2. Mid-Columbia

Travel time was computed in the mid-Columbia drainage from release site to Rock Island and McNary dams and within the index reach from Rock Island to McNary Dam. Wanapum and Priest Rapids dams are within the index reach. Between Priest Rapids and McNary reservoirs is a free-flowing section of river about 50

Table J. STEELHEAD TRAVEL TIME FROM RELEASE SITE IN THE SNAKE RIVER DRAINAGE MCNARY

BRAND	RELEASE SITE	# RELEASED	MEDIAN ----- 50% PASSAGE-----						AVE SPEED (MILES/DAY)	DISTANCE TRAVELED
			PASSAGE INDEX	RELEASE DATE	ARRIVAL DATE	DAYS OF TRAVEL	RIVER FLOW ^			
RA-IJ-1, 3, 4*	GRANDE RONDE RIVER	60,000	1,264	27-Apr	27-May	30	107.42	7.7	230	
RD-T-4	DWDRSHAK HATCHERY	35,025	547	01-May	26-May	19	108.75	11.2	212.9	
LA-IT-1, 3*	TUCANNON HATCHERY	40,000	5,239	06-May	30-May	24	108.75	5.4	130	
RA-1K-1, 3*	TUCANNON YATCHERY	40,000	8,377	01-May	27-May	20	107.10	6.5	130	
RA-7F-1	BEL OW LITTLE GOOSE	20,035	5,396	21-Apr	11-May	20	89.68	5.1	101	
RA-7F-3	BELOW LITTLE GOOSE	20,063	6,752	25-Apr	15-May	20	96.90	5.1	101	
RD-7F-1	BELOW LITTLE GOOSE	20,069	5,396	29-Apr	18-May	19	100.51	5.3	101	
LA-P-1 *	BELOW LITTLE GOOSE	4,319	2,172	26-Apr	02-May	6	93.23	16.8	101	
LA-P-2"	BELOW LITTLE GOOSE	4,176	2,156	29-Apr	07-Ray	8	92.55	12.6	101	
LA-P-3'	BELOW LITTLE GOOSE	1,966	2,313	05-May	13-May	8	103.21	12.6	101	
LA-P-4*	BELOW LITTLE GOOSE	4,150	2,147	10-May	19-May	9	95.71	11.2	101	
LA-W-1'	BELOW LITTLE GOOSE	1,219	2,265	15-May	22-May	7	102.91	14.4	101	
LA-W-2*	BELOW LITTLE GOOSE	4,250	1,981	20-May	26-May	6	109.99	16.8	101	
LA-W-3"	BELOW LITTLE GOOSE	4,250	1,531	24-May	29-May	5	129.59	20.2	101	
LA-W-b'	BELOW LITTLE GOOSE	1,287	598	27-May	31-May	4	171.36	25.3	101	
LA-IJ-1, 3, 4*	LYONS FERRY HATCHERY	60,000	20,914	25-Apr	14-May	19	96.59	4.8	91.4	
LA-1K-1, 3*	LYONS FERRY HATCHERY	40,000	10,750	25-Apr	18-May	23	101.03	4.0	91.4	
LA-7u-1	BELOW ICE HARBOR	11,998	3,958	21-Apr	03-May	12	100.16	3.4	41	
LA-7U-3	BLEOW ICE HARBOR	12,034	4,551	25-Apr	05-May	10	99.97	4.1	41	
LD-7U- i	BELOW ICE HARBOR	12,018	3,102	29-Apr	09-May	10	89.88	4.1	41	

River Flow is the average flow for 7 days around the estimated 50% passage date at Ice Harbor

For groups released below Ice Harbor, the average flow of the release date and the succeeding three days was used.

* Non-SMP marked groups.

Table K. STEELHEAD INDEX TRAVEL TIME FROM LOWER MONUMENTAL TO MCNARY
(INDEX DISTANCE IS 73.6 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			LMN	MCN	LMN	MCN			
LA-IT-1, 3*	TUCANNON HATCHERY	40,000	2,575	5,239	29-May	30-May	1	174.36	**
RA-1K-1, 3*	TUCANNON HATCHERY	40,000	2,832	8,377	22-mAY	27-May	5	114.81	14.7
RA-7F-1	BELDW LITTLE GOOSE	20,035	3,504	7,323	26-Apr	11-May	15	89.68	4.9
RA-7F-3	BELOW LITTLE GOOSE	20,063	3,157	6,752	30-Apr	15-May	15	96.90	4.9
RD-7F-1	BELOW LITTLE GOOSE	20,069	2,875	5,396	03-May	18-May	15	103.21	4.9
LA-P-1*	BELOW LITTLE GOOSE	4,319	531	2,172	28-Apr	02-May	4	93.23	18.4
LA-P-2*	BELOW LITTLE GOOSE	4,176	868	2,156	02-May	07-May	5	94.75	14.7
LA-P-3*	BELOW LITTLE GOOSE	4,966	794	2,313	08-May	13-May	5	100.51	14.7
LA-P-4*	BELOW LITTLE GOOSE	4,150	682	2,147	13-May	19-May	6	95.71	12.3
LA-W-1*	BELOW LITTLE GOOSE	4,249	698	2,265	18-May	22-May	4	102.91	18.4
LA-W-2*	BELOW LITTLE GOOSE	4,250	536	1,981	23-May	26-May	3	114.81	24.5
LA-W-3*	BELOW LITTLE GOOSE	4,250	663	1,531	26-May	29-May	3	140.39	21.5
LA-IJ-1, 3, 4*	LYONS FERRY HATCHERY	60,000	12,395	20,914	01-May	14-May	13	96.90	5.7
LA-1K-1, 3*	LYONS FERRY YATCHERY	40,000	6,120	10,750	02-May	18-May	16	103.21	4.6

^ River Flow is the average flow for 7 days around the estimated 50% passage date at Ice Harbor

* Non-SW marked groups.

** Unrealistic speeds are omitted.

miles long. For the most part, this section of river is fairly narrow with few "arms" or backwater areas. The projects in the mid-Columbia do not have bypass systems in place yet; therefore, Federal Energy Regulation Commission (FERC) mandated spill programs are in effect to assist migrating salmonids past these projects.

a. Spring Chinook

Four groups offmarked yearling spring chinook were released at mid-Columbia hatcheries to determine travel time and migration speed to downstream sampling sites. Travel time of the four SMP mark groups from Winthrop and Leavenworth Hatcheries to Rock Island sampling site ranged from 17 to 27 days, and the migration speed ranged from 2.5 to 4.5 miles/day. The average migration speed was 4.3 miles/day (Table L). The Leavenworth group migrated at approximately half the speed of the Winthrop group, with speeds of 2.5 versus 4.9 miles/day, respectively.

Travel time between Rock Island and McNary Dams ranged from 1 to 12 days, and the migration speed varied from 161.4 to 13.4 miles/day (Table M). As noted in the table, three of the four groups displayed extraordinary travel rates, 53.8 to 161.4 miles/day, which we believe to be much greater than what actually occurred. Sample sizes of the three releases from Winthrop Hatchery were Less than 170 fish at the Rock Island sampling site while recaptures at McNary totalled from 547 to 792 fish sampled. When recaptures are low, generally less than 200, and recaptures are recovered over a large span of time, arrival dates at a facility can be skewed either early or late. It appears that this phenomena might have seriously affected the median arrival date at Rock Island in 1986. To alleviate this problem, the FPC recommended that 1987 on-site releases of yearling spring chinook from Winthrop be increased from 35,000 to 50,000 fish. The release from Leavenworth Hatchery had 3 travel time (12 days) through this index reach (Rock Island to McNary) in

Table L. YEARLING AND SUBYEARLING CHINOOK FROM RELEASE SITE IN THE COLUMBIA RIVER DRAINAGE TO ROCK ISLAND

BRAND	RELEASE SITE	#	RELEASE INDEX	MEDIAN -----50 % PASSAGE-----		ARRIVAL DATE	DAYS OF TRAVEL	RIVER FLOW ^	AVE. SPEED (MILES/DAY)	DISTANCE TRAVELED
				PASSAGE RELEASE	PASSAGE ARRIVAL					

				YEARLING	CHINOOK					
RA- 7C- 1	WINTHROP	HATCHERY	34,466	169	21-Apr	16-May	25	141.64	4.8	120.6
RA- 7C- 3	WINTHROP	HATCHERY	34,485	132	25-Apr	22-May	27	125.06	4.5	120.6
RA- ' I T- 3	WINTHROP	HATCHERY	34,353	' 33	29-Apr	21-May	22	128.77	5.5	120.6
LA- 7T- 1	LEAVENWORTH	HATCHERY	40,602	313	23-Apr	10-May	17	141.55	2.5	43.2
				SUBYEARLING	CHINOOK					
RD- S- 1	WELLS	HATCHERY	100,447	531	29-May	09-Jun	11	150.70	5.7	62.2

^ River flow is the average flow for the 7 days around the 50% passage date at Rock Island.

Table M. YEARLING AND SUBYEARLING CHINOOK INDEX TRAVEL TIME FROM ROCK ISLAND TO MCNARY
(INDEX DISTANCE IS 161.4 MILES)

BRAND	RELEASE	SITE	# RELEASED	PASSAGE INDICIES		50% PASSAGE DATE		INDEX	RIVER FLOW	AVE. SPEED (MILES/DAY)
				RIS	MCN	RIS	MCN	TRAVEL TIME		
-----I-----										
				YEARLING		CHINOOK				
RA-7C-1	WINTHROP	HATCHERY	34,466	169	9,413	16-May	19-May	3	140.23	53.8
RA-7C-3	WINTHROP	HATCHERY	34,485	132	6,986	22-May	23-May	1	130.37	**
RA-7T-3	WINTHROP	HATCHERY	34,353	133	8,292	21-May	24-May	3	130.37	53.8
LA-7T-1	LEAVENWORTH	HATCHERY	40,602	313	12,371	10-May	22-May	12	138.65	13.5
				SUBYEARLING		CHINOOK				
RD-S-1	WELLS	HATCHERY	100,447	531	9,664	09-Jun	17-Jul	38	119.70	4.2

^ River flow is the average flow for the 7 days around the 50% passage date at Priest Rapids.

* Questionable speed

** Unrealistic speeds omitted

1986, identical to that in 1985, The Winthrop groups may have also. Due to the likelihood that this is skewed date, no reliable estimate of travel time for yearling chinook is available in the Rock Island to McNary index reach for 1986.

The travel times of the three Winthrop groups from release site to McNary Dam are very consistent, ranging from 25 to 28 days (Table N). Therefore, travel time through the entire reach may be more accurately compared with previous years. Travel time from release site to McNary Dam averaged 27 days for Winthrop groups and 29 days for the Leavenworth group. The migration speed of Winthrop groups ranged from 10.1 to 11.3 miles/day and averaged 10.4 miles/day. The migration speed of the Leavenworth group was 7.1 miles/day approximately 30 percent slower than the Winthrop groups.

Both river-run and Winthrop Hatchery marked control groups were released below Priest Rapids Dam. The migrating (in-river) fish were collected at Wanapum and Priest Rapids Dam, marked at Priest Rapids, and released below the dam. These marked fish were control releases from Grant County's transportation evaluation program. In-river released fish spanned over a month from the initial marking (April 28) to completion (May 22), while the hatchery groups were released on April 21, 25, and 29. The Winthrop controls (LA-7C-1, LA-7C-3, and LA-7U-1) had a range in travel time of 16 to 23 days to McNary Dam, with the average measured at 19.7 days (Table N). The speed ranged from 4.6 to 6.6 miles/day with an average of 5.3 miles/day. The in-river releases had a range in travel time of 5 to 12 days and averaged 8 days. Their migration speed ranged from 8.8 to 21.0 miles/day, with the average speed being 13.1 miles/day for the four combined mark groups.

Overall, the in-river marked fish traveled about 2.5 times faster than the Winthrop control releases. The Winthrop fish were transported directly from the hatchery and released below Priest Rapids, whereas the in-river fish had migrated from at least 60 miles upstream before being captured, marked, and

Table N. YEARLING AND SUBYEARLING CHINOOK TRAVEL TIME FROM RELEASE SITE IN THE COLUMBIA RIVER DRAINAGE TO MCNARY

BRAND	RELEASE SITE	% RELEASED	INDEX	MEDIAN -----50% PASSAGE-----		ARRIVAL DATE	DAYS OF TRAVEL	RIVER FLOW ^	AVE SPEED (MILES/DAY)	DISTANCE TRAVELED
				PASSAGE RELEASE DATE	PASSAGE ARRIVAL DATE					
YEARLING CHINOOK										
RA- 7C- 1	WINTHROP HATCHERY	34, 466	9, 413	21- Apr	19- May	28	136. 59	10. 1	282	
RA- 7C- 3	WINTHROP HATCHERY	34, 485	6, 966	25- Apr	23- May	28	139. 45	10. 1	202	
RA- 71- 3	WINTHROP HATCHERY	34, 353	6, 292	29- Apr	24- May	25	136. 65	11. 3	282	
LA- 7T- 1	LEAVENWORTH HATCHERY	40, 602	12, 371	23- Apr	22- May	29	135. 89	7. 1	204. 6	
LA- 7C- 3	BELOW PRIEST RAPIDS	12, 001	5, 646	21- Apr	16- May	23	159. 20	4. 6	105	
LA- 7C- 1	BELOW PRIEST RAPIDS	11, 989	6, 583	25- Apr	15- May	20	151. 54	5. 3	105	
LA- 7U- 1	BELOW PRIEST RAPIDS	11, 904	6, 326	29- Apr	15- May	16	163. 75	6. 6	105	
LA- RH, RR- 1*	BELOW PRIEST RAPIDS	19, 902	9, 452	01- May	13- May	12	139. 92	8. 8	105	
LA- RH, RR- 2*	BELOW PRIEST RAPIDS	21, 371	10, 757	07- May	16- May	9	141. 79	11. 7	105	
LA- RH, RR- 3'	BELOW PRIEST RAPIDS	13, 130	7, 940	15- May	21- May	6	137. 45	17. 5	105	
LA- Rt1, RR- 4*	BELOW PRIEST RAPIDS	6, 634	3, 198	23- May	28- May	5	114. 82	21. 0	105	
RA- 7U- 3	RINGOLD HATCHERY	50, 000	19, 466	03- Apr	09- Apr	6	143. 33	9. 3	56	
SUBYEARLING CHINOOK										
LA- T- 1	PRIEST RAPIDS HATCHERY	100, 216	29, 234	10- Jun	23- Jun	13	113. 91	8. 1	105	
LA- T- 4	PRIEST RAPIDS HATCHERY	100, 374	17, 826	19- Jun	14- Jul	25	114. 43	4. 2	105	
RD- S- 1	WELLS HATCHERY	100, 447	9, 660	29- May	17- Jul	49	118. 16	4. 6	223. 6	

^ River flow is the 7 day average flow around the estimated 50% passage date at Priest Rapids.

For groups released below Priest Rapids, the average flow of the release date and 3 succeeding days was used.

* Non-SMP marked groups. These releases were made after 2200 hours, therefore after computing the date of median release, the following day was assigned as the median release date.

Table O. STEELHEAD TRAVEL TIME FROM RELEASE SITE IN THE COLUMBIA RIVER DRAINAGE TO ROCK ISLAND

BRAND	RELEASE SITE	# RELEASE	PASSAGE INDEX	MEDIAN -----50 % PASSAGE-----		ARRIVAL DATE	DAYS OF TRAVEL	RIVER FLOW ^	AVE. SPEED (MILES/DAY)	DISTANCE TRAVELED
				RELEASE DATE	PASSAGE DATE					
LA-7N-1	EFFY BRIDGE METHOW R.	29,451	784	01-May	12-May	11	149.03	7.3		80.5
LA-7N-3	EFFY BRIDGE METHOW R.	30,046	757	05-May	14-May	9	147.15	8.9		80.5
LD-IN-1	EFFY BRIDGE, METHOW R.	29,992	290	09-May	19-May	10	136.60	8.1		80.5

^ River flow is the average flow for the 7 days around the 50% passage date at Rock Island.

Table P. STEELHEAD INDEX TRAVEL TIME FROM ROCK ISLAND TO YCNARY
(INDEX DISTANCE IS 161.4)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES 50% PASSAGE DATE				INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			RIS	MCN	RIS	MCN			
LA-IN-1	EFFY BRIDGE, METHOW R.	29,451	784	7,367	12-May	19-May	7	138.65	23.1
LA-7N-3	EFFY BRIDGE, METHOW R.	30,046	757	6,175	14-May	21-May	7	140.35	23.1
LD-7N-1	EFFY BRIDGE, METHOW R.	29,992	290	3,517	19-May	24-May	5	136.31	32.3

^ River flow is the average flow for the 7 days around the 50% passage date at Priest Rapids.

released. It is interesting to note that the earliest marked in-river group (LA-RH-1, LA-RR-1) traveled at a lesser rate of speed than the later marked fish. The early group speed of 8.8 miles/day compares more closely with the Winthrop controls average of 5.3 miles/day.

b. Sub-yearling Summer/Fall Chinook A single group of zero-age summer chinook was marked and released at Wells Hatchery to index travel time of summer migrants through the mid-Columbia reach. Marked releases were made on May 29 along with production releases. The fish moved fairly rapidly from Wells Hatchery to Rock Island Dam. Fifty percent had reached the sampling site by June 9, a travel time of 11 days and a migration speed of 5.7 miles/day (Table L). The migration from Rock Island to McNary Dam encompassed 38 days with the summer chinook traveling at a speed of 4.2 miles/day through this index reach (Table M).

Two additional releases of freeze branded sub-yearling chinook were released from Priest Rapids Hatchery, located immediately below the dam. Releases of 100,000 branded fish were made on June 10 and 19. The travel time to McNary Dam of the June 10 release was about one-half that of the latter group, 13 days and 25 days, respectively (Table N). Migration speed through this section was 8.1 and 4.2 miles per day for the same early and late releases, respectively. The late release migration speed is the same as the Wells Hatchery summer chinook migration speed of 4.2 miles/day between Rock Island and McNary.

c. Yearling Fall Chinook. This was the first season that yearling fall chinook were marked for monitoring in the Columbia River system. The mid-Columbia group of marked fall chinook were reared with production fish and released at Ringold Hatchery on April 3. Travel time of this group averaged 6 days to migrate to McNary, a rate of 9.3 miles/day (Table N).

d. Steelhead. Steelhead migration through the mid-Columbia was accomplished by utilizing survival study fish from Wells Hatchery. Test fish were released at

Effy Bridge, a site about 10 miles above the mouth of the Methow River, while the control fish were released below Priest Rapids Dam. Three groups of marked fish were released at each site.

Test fish were intercepted first at Rock Island Dam. The average travel time was 10 days with a range of 9 to 11 days (Table O). The average migration speed was 8.1 miles/day with a range of 7.3 to 8.9 miles/day for the three test releases.

Travel time of the three Wells steelhead releases from Rock Island to McNary ranged from 5 to 7 days (Table P). The travel time and migration rate through this index site was 6.3 days and 25.6 miles/day.

The test groups released into the Methow River had a range in travel time of 15 to 18 days to McNary Dam, an average of 16.3 days (Table Q). The speed ranged from 13.4 to 16.1 miles/day with the average being 14.8 miles/day. The three control groups had an average travel time and migration speed of 11 days and 9.5 miles/day respectively.

e. Sockeye. Six groups of sockeye were used to establish travel time estimates this season. These fish were marked at Priest Rapids and released below the project as controls for Grant County's transportation evaluation program. Where possible, mark groups with similar release dates were combined to increase release and subsequent recovery totals at McNary and John Day Dams. Because of low recoveries, the last release group (LA-L-3, and LA-V-4) was eliminated.

The sockeye moved through the system to McNary Dam in from 4 to 11 days with the average time of 6.5 days (Table R). The speed of the groups ranged from 9.5 to 26.3 miles/day, averaging 16.2 miles/day.

3. Lower Columbia

The lower Columbia River is considered to be that stretch of river from below McNary Dam to Bonneville Dam for smolt monitoring purposes. Because of sampling limitations at Bonneville Dam in 1986, the John Day use was utilized

Table Q. STEELHEAD TRAVEL TIME FROM RELEASE SITE IN THE COLUMBIA RIVER DRAINAGE TO McNARY

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDEX	MEDIAN	----- 50% PASSAGE -----		RIVER FLOW ^A	AVE SPEED (MILES/DAY)	DISTANCE TRAVELED
				RELEASE DATE	ARRIVAL DATE	DAYS OF TRAVEL			
LA- 7N-1	EFFY BRIDGE, METHOW R.	29,451	7,367	01-May	19-May	18	138.43	13.4	241.9
LA- 7N-3	EFFY BRIDGE, METHOW R.	30,046	6,175	05-May	21-May	16	138.65	15.1	241.9
LD- 7N-1	EFFY BRIDGE, METHOW R.	29,992	3,571	09-May	24-May	15	140.23	16.1	241.9
RA- 7P-1	BELOW PRIEST RAPIDS	11,780	3,916	01-May	13-May	12	139.92	8.8	105
RA- 7P-3	BELOW PRIEST RAPIDS	11,575	3,184	05-May	16-May	11	140.60	9.5	105
RD- 7P-1	BELOW PRIEST RAPIDS	11,943	2,229	09-May	19-May	10	135.58	10.5	105

River flow is the 7 day average flow around the estimated 50% passage date at Priest Rapids.

For groups released below Priest Rapids, the average flow of the release date and 3 succeeding days was used.

Table R. SOCKEYE TRAVEL TIME FROM RELEASE SITE IN THE COLUMBIA RIVER DRAINAGE TO McNARY

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDEX	MEDIAN	----- 50% PASSAGE -----		RIVER FLOW ^A	AVE SPEED (MILES/DAY)	DISTANCE TRAVELED
				RELEASE DATE	ARRIVAL DATE	DAYS OF TRAVEL			
; A- RH, RR- 1'	BELOW PRIEST RAPIDS	10,950	3,488	25-Apr	01-May	6	151.54	17.5	105
LA- RH- 2, RR- 4*	BELOW PRIEST RAPIDS	6,851	1,357	29-Apr	10-May	11	163.75	9.5	105
LA- RH, RR- 3*	BELOW PRIEST RAPIDS	5,092	1,653	09-May	16-May	7	135.58	15.0	105
LA- L, V- 1*	BELOW PRIEST RAPIDS	12,375	1,564	15-May	21-May	6	137.45	17.5	105
LA- L, V- 2*	BELOW PRIEST RAPIDS	14,736	5,566	11-May	26-May	5	131.40	21.0	105
LA- V- 3*	BELOW PRIEST RAPIDS	9,415	3,599	25-May	29-May	4	123.98	26.3	105

^A River flow is the 4 day average flow following the median release date at Priest Rapids.

* Non-SMP marked groups. These releases were made after 2200 hours, therefore after computing the date of median release the following day was assigned as the median release date.

to estimate travel time and migration speeds of the marked freeze brand groups. The John Day pool is a large reservoir 76.4 miles long with many side channels and backwater areas. A large reservoir has certain inherent disadvantages to migrating salmonids. Concern has been raised because of reduced water velocities from the greater surface area, increased numbers of predators, and the fact that John Day Dam is a high dam with 105 foot of head.

Fish from the Snake and mid-Columbia were used to determine travel time and migration speed. Also in-river yearling spring and sub-yearling fall chinook were marked at McNary as part of the Corps of Engineers transportation evaluation program and released below the dam site each evening after marking.

a. Yearling and Sub-Yearling Chinook

The average travel time of the two Rapid River Hatchery spring chinook groups in the McNary to John Day reach was 3 days and the average migration speed was 25.5 miles/day (Table D). This was approximately 30 percent faster than the travel times and migration speeds observed for other non-SMP groups between McNary and John Day (Table S). The Lower Granite (survival study) release groups averaged 19.1 miles/day, the Little Goose (transportation study) release groups averaged 16.4 miles/day, and the McNary (transportation study) release groups averaged 18.4 miles/day. These were in-river fish that were collected at McNary, freeze branded and released below the dam. On average, a period of 4 days is required for yearling spring chinook to move through John Day pool.

Travel time of Lyons Ferry yearling fall chinook in John Day pool was comparable to that of the yearling spring and summer chinook releases from the Snake River. They migrated through John Day pool at about 19.1 miles/day (Table S). Lyons Ferry sub-yearling fall chinook, on the other hand, take about 28 days to move through John Day pool, averaging about 2.7 miles/day (Table T). Apparently, the sub-yearling chinook rear in the John Day pool for almost one

Table S. YEARLING CHINOOK INDEX TRAVEL TIME FROM McNARY TO JOHN DAY
(INDEX DISTANCE IS 78.4 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX		AVE. SPEED (MILES/DAY)
			MCN	JDA	MCN	JDA	TRAVEL TIME	RIVER FLOW	
SNAKE RIVER DRAINAGE RELEASES									
LD-Y-1	RAPID RIVER	44,692	3,260	1,865	04-May	06-May	2	246.47	38.2
LD-Y-3	HELLS CANYON	44,754	3,475	1,710	28-Apr	02-May	4	250.81	19.1
RA-Y-2	DWORSHAK HATCHERY	40,675	3,997	1,373	11-May	12-May	1	262.81	**
RA-A,F,PI,R-1,2,3*	LOWER GRANITE DAM	54,000	8,685	4,678	05-May	08-May	3	256.56	25.5
LA-A,F,PI,R-1,2,3*	LOWER GRANITE DAM	54,000	6,190	5,398	01-May	05-May	6	246.99	19.1
RD-A,F,PI,R-1,2,3*	LOWER GRANITE DAM	54,000	8,421	5,298	02-May	07-May	5	241.36	15.3
LA-P-1*	BELOW LITTLE GOOSE	5,000	1,970	1,657	22-Apr	29-Apr	7	269.56	10.9
LA-P-2*	BELOW LITTLE GOOSE	5,000	3,524	2,335	27-Apr	02-May	5	250.81	15.3
LA-P-3*	BELOW LITTLE GOOSE	5,000	1,895	1,200	28-Apr	03-May	5	250.37	15.3
LA-W-1*	BELOW LITTLE GOOSE	5,000	2,318	1,706	03-May	07-May	4	247.34	19.1
LA-W-2*	BELOW LITTLE GOOSE	5,000	1,809	1,315	06-May	09-May	3	254.29	25.5
LA-W-3*	BELOW LITTLE GOOSE	5,000	2,119	1,053	10-May	14-May	4	267.13	19.1
RA-YA-1	LYONS FERRY HATCHERY	40,168	15,311	8,817	27-Apr	01-May	4	254.71	19.1
MID-COLUMBIA DRAINAGE RELEASES									
RA-7C-1	WINTHROP HATCHERY	34,466	9,413	2,142	19-May	21-May	2	263.44	38.2
RA-7C-3	WINTHROP HATCHERY	34,485	6,986	1,958	23-May	25-May	2	256.89	38.2
RA-7T-3	WINTHROP HATCHERY	34,353	8,292	1,937	24-May	25-May	1	256.89	**
LA-7T-1	LEAVENWORTH HATCHERY	40,602	12,371	3,314	22-May	23-May	1	256.03	**
LA-7C-5	BELOW PRIEST RAPIDS	12,001	5,545	2,380	14-May	18-May	6	257.27	19.1
LA-7C-1	BELOW PRIEST RAPIDS	11,986	6,583	2,342	5-May	19-May	4	263.73	19.1
LA-7U-1	BELOW PRIEST RAPIDS	11,304	6,328	2,623	15-May	19-May	4	263.13	19.1
LA-RH,RR-1*	PRIEST RAPIDS DAM	19,907	9,452	4,306	13-May	17-May	4	255.41	19.1
LA-RH,RR-2*	PRIEST RAPIDS DAM	21,371	10,757	5,689	16-May	20-May	6	266.83	19.1
LA-RH,RR-3*	PRIEST RAPIDS DAM	12,130	7,940	2,268	21-May	23-May	2	256.03	38.2
LA-RH,RR-4*	PRIEST RAPIDS DAM	5,634	3,198	1,094	28-May	30-May	2	338.56	38.2
RA-7U-3	RINGOLD HATCHERY	50,000	19,466	4,330	09-Apr	17-Apr	9	280.40	9.6
LOWER COLUMBIA DRAINAGE RELEASES									
LA-15-3*	BELOW McNARY DAM	5,620	N/A	846	03-May	07-May	4	241.34	19.1
LA-1V-3*	BELOW McNARY DAM	5,054	N/A	753	07-May	11-May	6	260.40	19.1
LA-1D-3*	BELOW McNARY DAM	5,166	N/A	1,047	09-May	13-May	6	265.33	19.1
LA-1K-3*	BELOW McNARY DAM	5,235	N/A	1,053	11-May	15-May	4	260.84	19.1
LA-1F-3*	BELOW McNARY DAM	5,329	N/A	1,021	12-May	16-May	4	256.64	19.1
LA-1S-1*	BELOW McNARY DAM	5,111	N/A	1,086	19-May	23-May	4	256.03	19.1
LA-1M-*	BELOW McNARY DAM	5,079	N/A	765	23-May	28-May	5	285.87	15.3

River flow is the average flow for 7 days around the 50% passage date at John Day

* Non-SMP marked groups. These groups which were released below McNary were released after 2200 hours, therefore after computing the date of median release, the following day was assigned as the release date.

** Unrealistic speed inferred

month.

Yearling spring chinook from the mid-Columbia releases at Winthrop and Leavenworth hatcheries appeared to have traveled from McNary to John Day Dam in 1 to 2 days. This few number of days is highly unlikely based on what was observed for the mid-Columbia releases below Priest Rapids. The Winthrop control groups averaged 4 days travel time and the in-river groups averaged 3 days travel time in John Day pool. In general, a 3 to 4 day travel time for yearling chinook salmon appears reasonable for 1986.

The yearling fall chinook from Ringold Hatchery traveled through John Day pool in 8 days, at a rate of 9.6 miles/day (Table S). This stock maintained a fairly consistent rate of travel, about 9.5 miles/day from their release site to McNary and John Day dams, in contrast to the Lyons Ferry yearling fall chinook which demonstrated an increasing migration speed as they moved downstream from 6.7 miles/day between Lower Monumental and McNary dams to 19.1 miles/day in John Day pool.

The two Priest Rapids Hatchery sub-yearling chinook groups were recovered in sufficient numbers to adequately assess travel time to John Day Dam. The June 10 release group moved more quickly to McNary Dam than did the June 19 release, and it maintained a 10-day lead time to John Day. The travel time and migration speed of Priest Rapids Hatchery sub-yearling chinook groups through John Day pool was 17 days and 15 days for the early and late release, respectively. The average travel time was 16.0 days, a speed of 4.8 miles/day (Table T).

In-river sub-yearling chinook, mostly from the mid-Columbia, were marked and released immediately below McNary Dam. This group demonstrated a range of travel time to John Day Dam of 11 to 24 days with the overall average time through this index reach of 17.4 days and a speed of 4.4 miles/day. These fish migrated near the average speed of the two SMP sub-yearling releases from Priest

Table T SUBYEARLING CHINOOK INDEX TRAVEL TIME FROM MCNARY TO JOHN DAY
(INDEX DISTANCE IS 76.4 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX		AVE SPEED (MILES/DAY)
			MCN	JDA	MCN	JDA	TRAVEL TIME	RIVER FLOW ^	
SNAKE RIVER DRAINAGE RELEASES									
RA-T-5	LYONS FERRY HATCHERY	81,003	19,511	1,021	26-Jun	24-Jul	28	177.57	2.7
MID-COLUMBIA DRAINAGE RELEASES									
LA-T-1	PRIEST RAPIDS HATCHERY	100,276	29,234	3,290	23-Jun	10-Jul	17	139.57	4.5
LA-T-4	PRIEST RAPIDS HATCHERY	100,374	17,826	2,324	14-Jul	29-Jul	15	151.74	5.1
LOWER COLUMBIA DRAINAGE RELEASES									
LA-3X-3'	BELOW MCNARY DAM	10,000	N/A	955	20-Jun	01-Jul	11	140.09	6.9
LA-3J-3*	BELOW MCNARY DAM	10,000	N/A	1,120	24-Jun	15-Jul	21	181.06	3.6
LA-3C-3*	BELOW MCNARY DAM	10,810	N/A	1,396	03-Jul	22-Jul	19	176.41	4.0
LA-3U-3*	BELOW MCNARY CAM	10,000	N/A	968	14-Jul	28-Jul	14	155.64	5.5
LA-7H-3*	BELOW MCNARY OAR	10,000	N/A	1,162	17-Jul	31-Jul	14	150.26	5.5
LA-10-3*	BELOW MCNARY DAM	10,000	N/A	1,012	20-Jul	04-Aug	15	140.20	5.1
LA-7H, 10-1*	BELOW MCNARY DAP	20,000	N/A	1,712	23-Jul	11-Aug	19	135.47	4.0
LA-17-1*	BELOW MCNARY DAM	10,000	N/A	995	25-Jul	13-Aug	19	142.53	4.0
LA-3X-1 *	BELOW MCNARY DAM	13,003	N/A	751	31-Jul	18-Aug	18	128.76	4.2
LA-3L-1*	BELOW MCNARY OAM	5,826	N/A	347	02-Aug	26-Aug	24	114.26	3.2

River flow is the average flow for 7 days around the 50% passage date at John Day.

* Non-SMP marked groups. These releases were made after 2200 hours, therefore after computing the median release date, the following day was assigned as the release date.

Rapids (4.8 miles/day), but faster than the Lyons Ferry release (2.7 miles/day).

All sub-yearling groups appear to take their time migrating through this large reservoir. When the Bonneville Dam sampling system works satisfactorily, as anticipated in 1987, the travel time through the remaining two reservoirs should give a better idea on flow/travel time relationship through the Columbia River system.

b. Steelhead

The Lyons Ferry Hatchery steelhead releases were the only groups from the Snake River drainage that were recovered at John Day Dam with adequate sample sizes to determine travel time. The Lyons Ferry Hatchery groups travelled this index reach in 2 to 3 days, after excluding five groups with negative, zero, or one day estimates (Table U). The average speed for the valid groups was 31.8 miles/day. The in-river marked steelhead groups traveled between McNary and John Day dams in 2 to 3 days, averaging 2.1 days and speeds of 35.7 miles/day. On the average, Snake River steelhead appear to move through John Day pool about $1\frac{1}{2}$ times faster than Snake River yearling chinook.

When examining the migration of the Wells test and control fish to John Day, it was noted that migration speed from McNary to John Day was at least 76.4 miles/day based on a 1-day travel time average. This would appear to be out of the realm of the rate that a fish can move downstream under normal flow conditions which occurred during this year's salmonid outmigration in the Columbia River. Thus, no valid estimate was made in the McNary to John Day index reach.

In general, a 2 day travel time in John Day pool for steelhead trout appears reasonable for 1986.

c. Sockeye

The sockeye groups from the transportation studies had a range in travel time through the McNary to John Day index reach of 1 to 11 days and averaged

Table U. STEELHEAD INDEX TRAVEL TIME FROM MCNARY TO JOHN DAY
(INDEX DISTANCE IS 76.4 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			MCN	JDA	MCN	JDA	TRAVEL TIME		
SNAKE RIVER DRAINAGE RELEASES									
LA-IT-1,3*	TUCANNON HATCHERY	40,000	5,239	2,039	30-May	30-May	0	338.56	**
RA-1K-1,3*	TUCANNON HATCHERY	40,000	8,377	4,388	27-May	30-May	3	338.56	25.5
RA-7F-1	BELOW LITTLE GOOSE	20,035	7,323	4,244	11-May	13-May	2	265.33	38.2
RA-7F-3	BELOW LITTLE GOOSE	20,063	6,752	3,717	15-May	16-May	1	256.64	**
RD-7F-1	BELOW LITTLE GOOSE	20,069	5,369	2,312	18-May	17-May	-1	255.44	**
LA-P-1*	BELOW LITTLE GOOSE	4,319	2,172	1,388	02-May	04-May	2	248.63	38.2
LA-P-2*	BELOW LITTLE GOOSE	4,176	2,156	1,233	07-May	09-May	2	259.29	38.2
LA-P-3*	BELOW LITTLE GOOSE	4,966	2,313	1,564	13-May	15-May	2	260.84	38.2
LA-P-4*	BELOW LITTLE GOOSE	4,150	2,147	949	19-May	21-May	2	263.44	38.2
LA-W-1*	BELOW LITTLE GOOSE	4,249	2,265	904	22-May	24-May	2	251.16	38.2
LA-W-2*	BELOW LITTLE GOOSE	4,250	1,981	658	26-May	29-May	3	308.51	25.5
LA-W-3*	BELOW LITTLE GOOSE	4,250	1,531	633	29-May	31-May	2	361.33	38.2
LA-IJ-1,3,4*	LYONS FERRY HATCHERY	60,000	20,914	13,230	14-May	16-May	2	256.64	38.2
LA-1K-1,3*	LYONS FERRY HATCHERY	40,000	10,750	4,734	18-May	21-May	3	263.44	25.5
LA-7U-1	BELOW ICE HARBOR	11,998	3,958	3,081	03-May	02-May	-1	250.81	**
LA-7U-3	BELOW ICE HARBOR	12,034	4,551	3,102	05-May	07-May	2	247.34	38.2
LD-7U-1	BELOW ICE HARBOR	12,018	3,102	1,623	09-May	10-May	1	260.00	**
MID-COLUMBIA DRAINAGE RELEASES									
LA-7N-1	EFFY BRIDGE, METHOW R.	29,451	7,367	3,632	19-May	19-May	0	263.73	**
LA-7N-3	EFFY BRIDGE, METHOW R.	30,046	6,175	2,441	21-May	22-May	1	262.26	**
LD-7N-1	EFFY BRIDGE, METHOW R.	29,992	3,517	1,198	24-May	24-May	0	251.16	**
RA-7P-1	PRIEST RAPIDS DAM	11,780	3,916	2,926	13-May	14-May	1	267.13	**
RA-7P-3	PRIEST RAPIDS DAM	11,575	3,184	2,368	16-May	15-May	-1	260.84	**
RD-7P-1	PRIEST RAPIDS DAM	11,943	2,229	1,722	19-May	20-May	1	266.83	**

^ River flow is the average flow for 7 days around the 50% passage date at John Day.

* Non-SMP marked groups.

** Unrealistic speeds are omitted.

Table V. SOCKEYE INDEX TRAVEL TIME FROM MCNARY TO JOHN DAY
(INDEX DISTANCE IS 76.4 MILES)

BRAND	RELEASE SITE	# RELEASED	PASSAGE INDICES		50% PASSAGE DATE		INDEX TRAVEL TIME	RIVER FLOW ^	AVE. SPEED (MILES/DAY)
			MCN	JDA	MCN	JDA			
LA-RH,RR-1*	PRIEST RAPIDS DAM	10,950	3,488	1,195	01-May	12-May	11	262.81	6.9
LA-RH-2,RR-4*	PRIEST RAPIDS DAM	6851	1,375	580	10-May	16-May	6	256.64	12.7
LA-RH,RR-3*	PRIEST RAPIDS DAM	5092	1,653	406	16-May	21-May	5	263.44	15.3
LA-L,V-1*	PRIEST RAPIDS DAM	12375	4,564	901	21-May	24-May	3	251.16	25.5
LA-L,V-2*	PRIEST RAPIDS DAM	14736	5,566	831	26-May	28-May	2	285.87	38.2
LA-V-3*	PRIEST RAPIDS DAM	9415	3,599	449	29-May	30-May	1	338.56	**

^ River flow is the average flow for 7 days around the 50% passage date at John Day.

* Non-SMP marked groups.

** Unrealistic speeds omitted.

5.4 days, excluding the 1 day travel time estimate of the last group released (Table V). The migration speed of the sockeye in John Day pool increased for each successive release, ranging from 4.9 to 38.2 miles/day. The average speed was estimated at 14.1 miles/day.

4. Comparison of travel time and migration speed among years

Travel time and migration speed from release site to McNary Dam are compared in Table 13 for 1984 to 1986. In general, even though 1984 had the highest flows and spills, followed by 1986 and lastly 1985, there is no consistent corresponding correlation with travel time and speed of marked groups from release site to McNary. This may be due to the lack of large enough differences between flows for these three years. A discussion of this phenomenon appears in Section V.

Average travel time and migration speed within the two index reaches where comparable sampling over the three year period occurred are listed in Table 14. Steelhead results follow the pattern expected; i.e., fastest speed in 1984, followed by 1986, and lastly 1985, in both the Snake and mid-Columbia index reaches. Yearling chinook in the Snake index reach exhibited a slower speed in 1986 than 1985, contrary to expectation, but this is partially due to the slow travel time of Dworshak Hatchery spring chinook in 1986. Omitting that group, the annual travel time index would be 13 days for 1985 and 12.3 days for 1986. Annual migration speeds would still be close, but they would be faster for 1986 as expected. The appearance of a faster travel time for sub-yearling chinook between Rock Island and McNary in 1985 than 1986 may be circumstantial. High flows early in June moved wild and hatchery sub-yearling chinook quickly through the upper reaches of the mid-Columbia in 1986. The median passage date at Rock Island was one month earlier in 1986 than 1985. Median passage occurred about the same time each year at McNary. It appears sub-yearling chinook were moved below Rock Island before they were ready to continue their downstream migration.

TABLE 13 **Summary of Travel Time of Marked Salmon and Steelhead
in the Columbia Basin, 1984 - 1986.**

<u>Species</u>	<u>Reach</u>	<u>TRAVEL TIME</u>			<u>Speed Miles/day</u>		
		<u>Travel</u>	<u>Time(Days)</u>		<u>1984</u>	<u>1985</u>	<u>1986</u>
		<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
<u>Mid-Columbia Drainage</u>							
SpCh	Winthrop H.-MCN	26.0	32.8	27.0	10.8	8.6	10.4
Stlhd	Methow R.-MCN	16.0	14.7	16.3	14.8	15.9	14.8
Stlhd	Priest Rpds.-MCN	6.0	6.6	11.0	18.7	16.7	9.5
Sock	Priest Rpds.-MCN	4.5	6.7	6.5	24.0	17.6	16.2
SuCh	Wells H.-MCN	51.0	42.0	49.0	4.4	5.6	4.6
FaCh	Priest Rpds.-MCN	28.0	19.0	19.0	3.8	5.5	5.5
<u>Snake River Drainage</u>							
YgCh	Rapid R.-MCN	47.0	35.0	29.0	6.6	9.0	10.8
YgCh	Hells Cyn.-MCN	38.0	40.0	33.0	7.4	7.0	8.5
YgCh	Sawtooth-MCN	52.0	50.0	46.0	11.6	12.1	13.2
YgCh	S.F.Salmon R.-MCN	45.0	53.0	49.0	9.5	8.0	8.7
YgCh	Dworshak-MCN	--	35.0	39.0	--	6.1	5.5
Stlhd	Dworshak-MCN	16.0	12.0	19.0	13.3	17.7	11.2
Stlhd	GrandeRonde-MCN	--	25.0	30.0	--	9.2	7.7

TABLE 14 Summary of Annual Indices of Migration of Marked Salmon and Steelhead in the Columbia Basin, 1984 - 1986.

		ANNUAL INDEX									
<u>Species</u>	<u>Reach</u>	<u>Number</u>	<u>Replicates</u>			<u>Travel Time(Days)</u>			<u>Speed Miles/day</u>		
		<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	
YgCh	LWG-MCN	5	5	6	10.0	12.8	13.8	14.0	11.0	10.1	
Stlhd	LWG-MCN	1	3	3	7.0	9.3	8.0	20.0	15.6	17.5	
*YgCh	RI-MCN	--	6	4	--	7.7	*	--	21.0	*	
Stlhd	RI-MCN	--	3	3	--	7.7	6.3	--	21.0	25.6	
SubYrCh	RI-MCN	--	2	1	--	14.0	38.0	--	11.5	4.2	

* see text (section D, 2, a) for explanation of travel time and migration speed.

E. Survival Studies

The study design used in this program has one overriding assumption: test and control groups are assumed to be equal in all respects except for the test group experiencing passage conditions in the river between test and control release points. This implies that (1) sample rates and project operations experienced by the test and control groups at McNary are equal, and (2) pre-release treatment of the two groups is identical. The data must be evaluated in relation to the assumption to explore for bias which might invalidate results.

Questions are posed in Table 15 to aid in examining the data in relation to design assumptions. These questions simply re-phrase the criteria used in the 1984 and 1985 SMP studies. The objective is to identify factors other than the test factor, which could differentially affect the recovery rates of the test and control groups. The evaluation will be subjective, and as such open to interpretation. Because the control groups are the standard against which the recovery of the test fish is judged, the examination is especially directed at identifying unusual behavior or recovery of the control groups.

Assumption (b) in Table 15 is examined in this section. The factor length is used as one indication of randomness in the selection of test and control fish. Travel time, migration speed, and recovery rate of the controls are factors aimed at identifying behavioral features of the controls which could bias the results. The examination of assumption (a) is deferred to Section V because it is more hypothetical in nature.

1. Length Distribution Evaluation

Length is an important criteria in assessing the degree to which test and control groups were randomly selected from a common pool of fish, and whether the two groups were truly paired. Length frequency data for the mark groups are shown graphically in Figures 21, 22, and 23.

TABLE 15 Questions to aid in evaluating whether smolt survival data satisfies design assumptions.

Assumption:

- (a) Equality of recovery rates between test and control groups.

Question:

- 1.. Were adequate measures taken to correct for differences in sample rate and project operations since mixing of test and control groups at recovery site was not possible?

Assumption:

- (b) Equality of pre-release treatment of test and control groups and equality of behavioral response of both groups after release.

Question:

- i. Were the selection and marking of test and control groups random so that significant length differences between groups do not occur?
- ii. Do behavioral differences occur between test and control groups resulting from differences in pre-release stress level or physiological condition?

Indicators include:

- (1) Decline in the recovery rate of controls over time.
- (2) Decline in travel rate of controls over time,

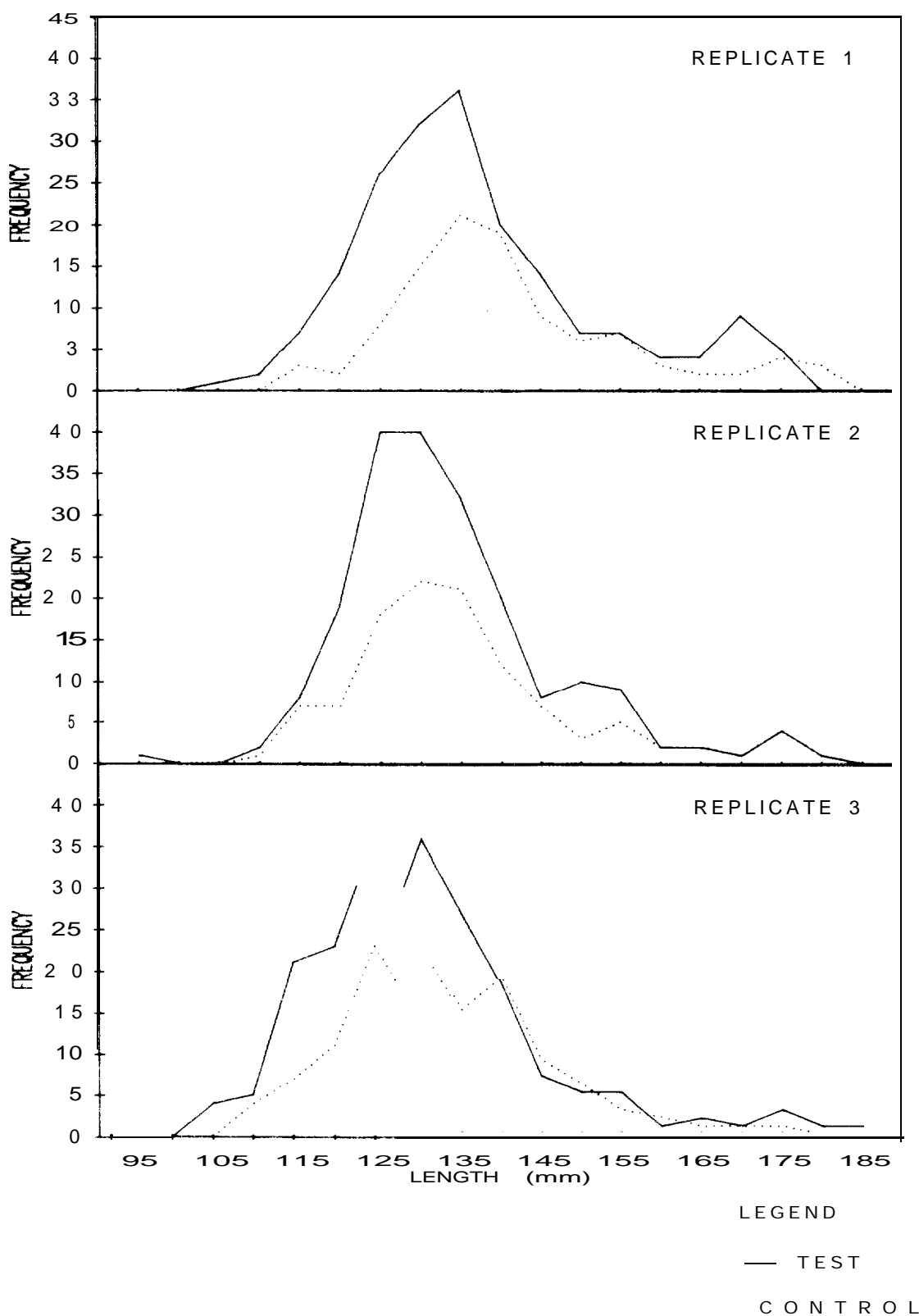


FIGURE 21 Length Frequency Distribution of Winthrop Hatchery Spring Chinook Test and Control Groups.

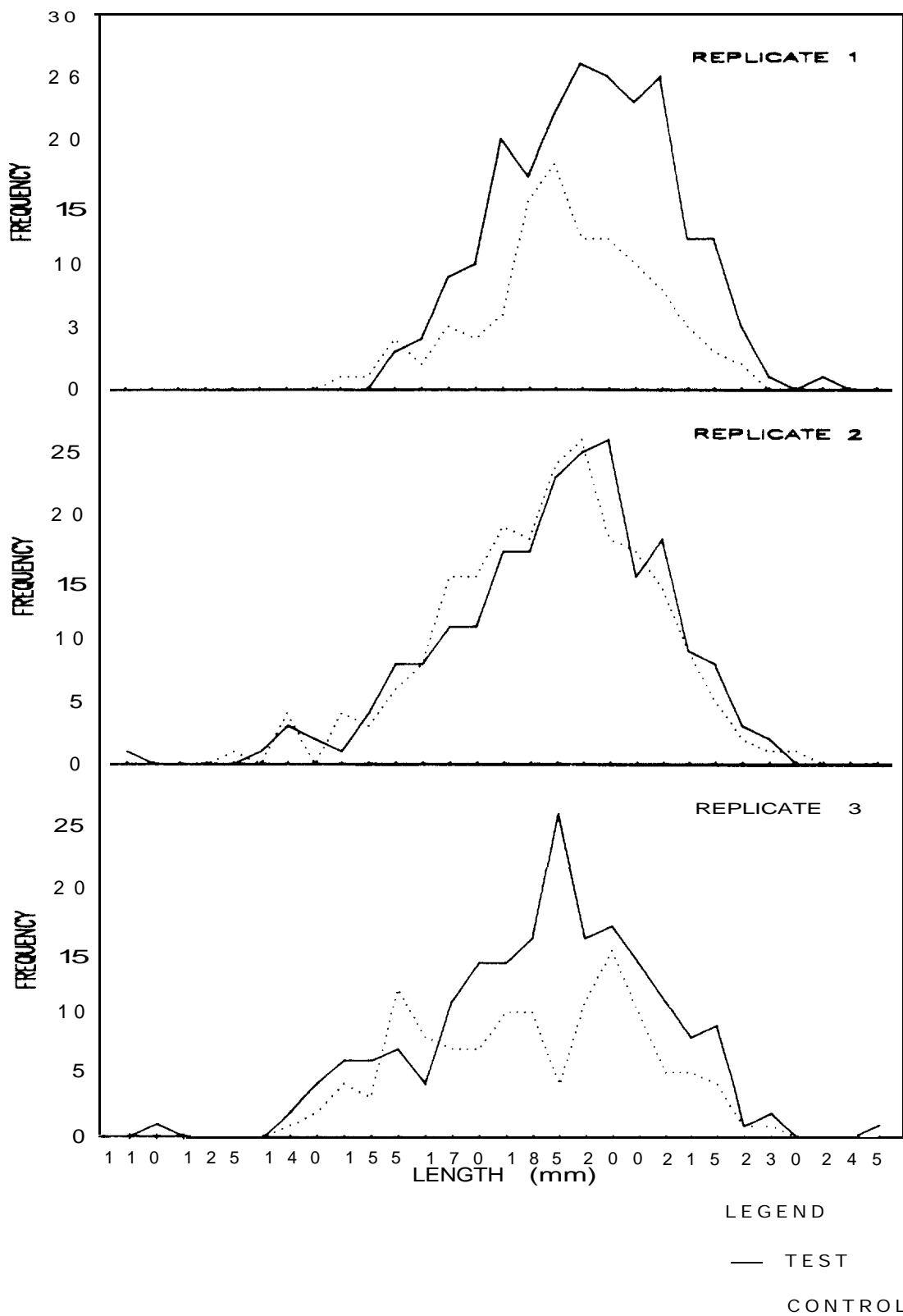


FIGURE 22 Length Frequency Distribution of Wells Hatchery Steelhead Test and Control Groups.

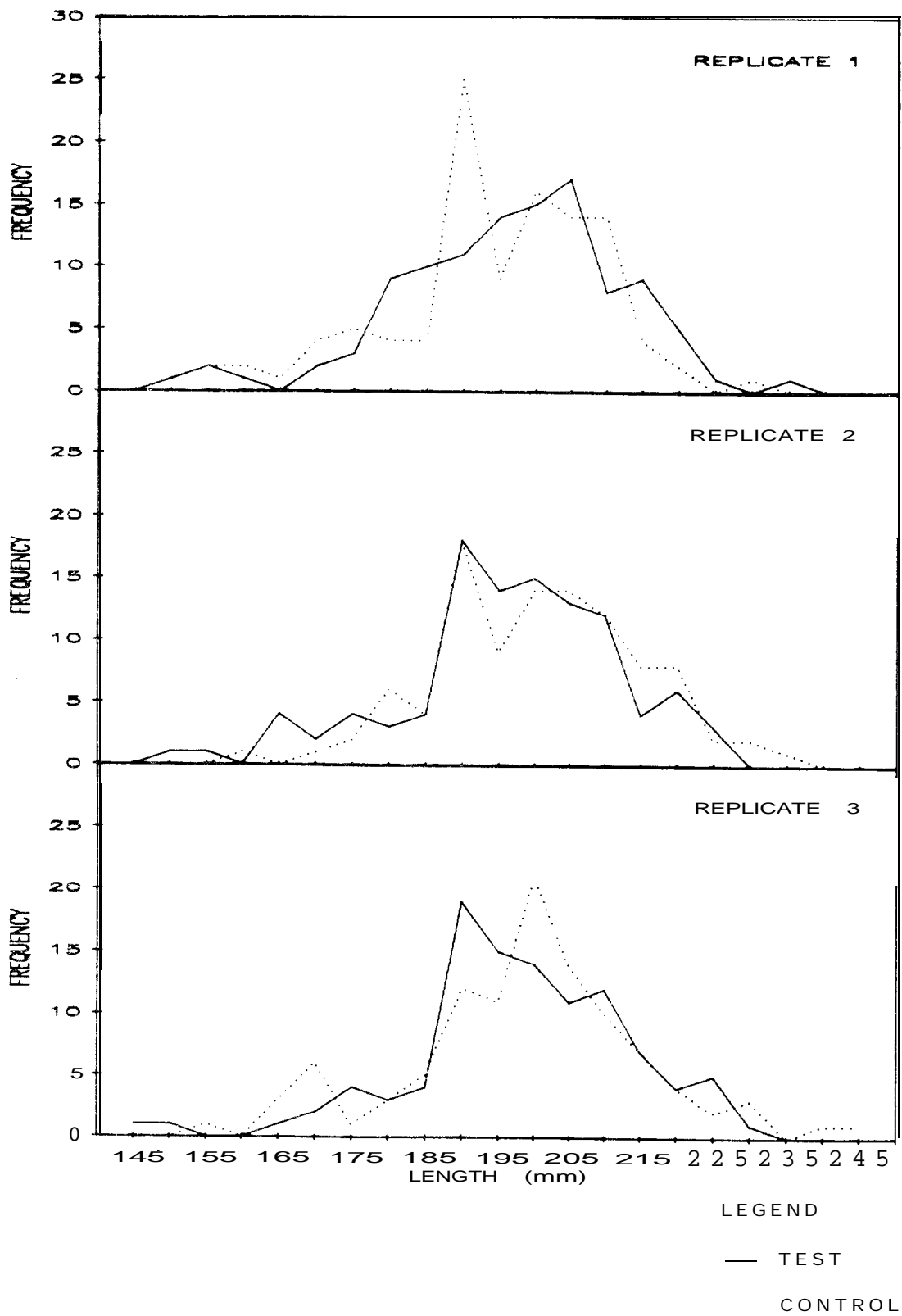


FIGURE 23 Length Frequency Distribution of Lyons Ferry Steelhead Test and Control Groups.

TABLE 16

Summary of length data and t-test comparison
for 1986 survival study groups.

<u>Hatchery</u>	<u>Code</u>	<u>Average Length(mm)</u>	<u>n</u>	<u>t</u>
Winthrop	WiT1	136.97	188	
	WiC1	141.44	104	-2.45

Winthrop	WiT2	133.62	199	
	WiC2	135.58	113	-1.21

Winthrop	WiT3	133.41	160	
	WiC3	135.78	102	-1.46

Wells	WeT1	196.26	215	
	WeC1	192.18	108	2.22

Wells	WeT2	189.93	213	
	WeC2	188.40	210	0.82

Wells	WeT3	187.68	190	
	WeC3	185.13	120	1.05

Lyons Ferry	LyT1	196.65	109	
	LyC1	194.49	108	1.05

Lyons Ferry	LyT2	196.68	104	
	LyC2	200.88	102	-1.97

Lyons Ferry	LyT3	198.37	104	
	LyC3	199.19	105	-0.38

*

Significant difference compared to t (0.05,d.f.= 100)= 1.98

Comparison of the Lengths of the test and control groups within a replicate was made using a standard t-test (Table 16). For samples of this size, the critical value at an alpha Level or 0.05 is 1.98. The minimum length difference which turned out to be significant between control and test groups in the t-test comparisons was 4 mm. Only two replicates showed a significant difference.

The first replicate of spring chinook test and control groups from Winthrop Hatchery differed significantly in size. Test and control groups did not differ significantly in size for the second and third Winthrop replicates. The control groups were all larger in size than test groups for the three Winthrop replicates. This is probably related to the fact that, after marking, the control groups at Winthrop were held over winter at a lesser density than were the test groups. The groups did not differ in size at the time of marking.

The steelhead test and control group from Wells Hatchery differed significantly in size for the first replicate. The other steelhead control and test groups from Wells or Lyons Ferry hatcheries did not differ significantly in size. Fish were randomly marked at Wells Hatchery just prior to the release date and there appears to be no reason that the control group should vary significantly in length from the test group. Varying 4.0mm on larger steelhead which average about 195 mm probably imposes no real difference in compatibility between test and control groups and may have been the degree of chance that is always present in a study.

Although two groups were shown to differ significantly in size, the amount of difference may be minor from a biological standpoint. This is especially true since fish lengths are measured to the nearest 5 mm. In conclusion, it appears unlikely that the small length differences observed in 1986 had any effect on survival of paired test versus control groups after release.

2. Fish Health and Brand Quality

Fish health (quality) is important to assess since the condition of study fish upon release could affect their recovery at McNary and accordingly influence the reliability of fish survival estimates. The evaluation of fish quality is based primarily upon subjective observations of population behavior (e.g. feeding response, smolt behavior) and visual appearance. Individual fish are inspected for sign of physical or internal disorder.

Winthrop: The Winthrop Hatchery test and control fish appeared generally healthy. The fish were observed to have a low (10%) incidence of sunburn: a nutritional disease (pers. comm. Ray Brunson, pathologist, USFWS) which causes very low morbidity or mortality at hatcheries. Since the rate of sunburn was about equally distributed in all test and control groups, any adverse effect would also be about equal. Sunburn was not considered a factor in estimation of survival. About 1.0% were noted with swollen bellies, which generally indicates kidney infection. No other fish abnormality was observed.

A total of 866 spring chinook were sampled at this hatchery for fish length and brand quality information. Brand legibility ranged from 91.9% to 96.4%, and it was no different on average between test (94.5%) and control (94.4%) groups (Table 17). The category 2 level of brands are light and consequently are more difficult to detect. There was no indication of brand burning in any of the samples.

Wells: The Wells Hatchery test and control steelhead inspected just prior to release appeared generally healthy. Feeding activity began immediately following the branding operation and was vigorous and normal throughout the holding period. A low incidence of split caudal fins was observed. The total mortality of marked groups of Wells steelhead between marking and release

TABLE 17

Brand legibility of survival study fish

<u>Hatchery</u>	<u>Group</u>	<u>Legible Brands</u>				<u>Unlegible Brands</u>	
		<u>Total (Category 1+2)</u>		<u>Category 2</u>		<u>Number</u>	<u>Percent</u>
		<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>		
Winthrop	Test 1	178	94.7	22	12.4	10	5.3
	Control 1	99	95.2	4	4.0	5	4.9
	Test 2	187	94.0	21	11.2	12	6.0
	Control. 2	107	96.4	17	15.9	4	3.6
	Test 3	151	94.4	15	9.9	9	8.1
	Control 3	91	91.9	8	8.8	a	8.1
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Wells	Test 1	203	94.4	117	54.4	12	5.6
	Control 1	105	97.3	48	44.4	3	2.8
	Test 2	208	98.1	62	29.2	4	1.9
	Control 2	203	96.7	45	21.4	7	3.3
	Test 3	190	100	134	70.5	0	0.0
	Control 3	120	100	86	71.7	0	0.0
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Lyons Ferry	Test 1	109	100	2	1.8	0	0.0
	Control. 1	106	100	2	1.9	0	0.0
	Test 2	103	99	1	1.0	1	1.0
	Control 2	102	100	3	2.9	0	0.0
	Test 3	104	100	3	2.9	0	0.0
	Control 3	105	100	3	2.9	0	0.0

(a period of a few days) was about 70 fish, or approximately 0.1%.

The most common disorder was lightly burned freeze brands which did not appear to create a health problem. Brand burning was more prevalent in test groups (Test 1: 3.3%, Control 1: 0%; Test 2: 14.2%, Control 2: 9.1%; Test 3: 6.8%, Control 3: 1.0%). A differential proportion in burned brands of paired test and control groups is a potential problem in survival estimation if burning causes death or reduced migratory urge. However, burning was generally very light causing small areas of whitening of the brand. The burning was not observed to cause sluffing of the epidermis or fungus, as was noted during the 1985 season. Fish mortality due to burning was not observed during the 1985 season; therefore, it was assumed that mortality due to burning was not a problem this year, since burning was far less extensive.

A total of 1056 fish were sampled at the hatchery for length and brand quality data. Brand legibility ranged from 94.2% to 100% (Table 17). Category 2 brands were very common in the legible totals and ranged from 8.7% in control 1 to 71.7% in the control 3 group. Brand burning did not affect brand interpretation.

Lyons Ferry: The Lyons Ferry Hatchery test and control steelhead prior to release appeared generally healthy. Feeding activity began immediately following the branding operation and was vigorous and normal throughout the holding period. Fewer precocious males and undersized fish were observed in this season's mark samples. The total mortality of marked groups of Lyons Ferry steelhead between marking and release (a period of approximately 30 days) was 62 fish. The loss of study fish due to transport to the Little Goose and Ice Harbor release sites was negligible.

About 630 steelhead were sampled at this facility to obtain data on length and brand quality. Brand quality ranged from 98.2% to 100% legible (Table 17).

Included in the total of legible brands are 14 brands of diminished legibility (Category 2). There was one unlegible brand (1.0%) found in the test 2 group. Light brand burning (Category 6) was 41.3% in test 1, 28.3% in control 1; 8.6% in test 2, 15.7% in control 2; 1.9% in test 3, and 1.0% in control 2 groups. There were 2 fish in the control 1 group which were not branded. Since almost all fish had legible brands, this light burning was not considered a factor in reliability of brand interpretation at downstream sampling sites.

Wells and Lyons Ferry Smolt Condition: The condition of steelhead smolts used for paired test and control groups at the Lyons Ferry and Wells hatcheries were as identical as possible. Fish selected for each test and control pair were taken from a lot of fish which were mixed together in a common raceway prior to branding. Although test and control groups were apparently identical, steelhead appeared more extensively smolted at Wells Hatchery when compared to Lyons Ferry. This assessment was based on the observation of the more silvery appearance of Wells study fish compared to the fish at Lyons Ferry. In addition, a number of fish rejected during the branding process due to being undersized or precocious was negligible at Wells; whereas there was an approximate 4% rejection rate at Lyons Ferry. Further, the method used to obtain the study fish at their two hatcheries suggested that smolt condition may be different. Fish at Lyons Ferry Hatchery were obtained from rearing ponds after voluntary release of the majority of production fish; however, at Wells, fish were obtained directly from the Population of fish which had exited rearing ponds in response to migration urges.

3. Travel Time

Travel time of test and control groups was examined for differences between paired groups which might bias the survival estimates. Travel time and migration speed from the point of release to McNary Dam was used for all groups.

This includes the mid-Columbia test groups, since the Rock Island to McNary migration speed estimates were abnormally fast for the three test releases from Winthrop Hatchery. Wells steelhead test groups were the fastest migrants, averaging 14.8 miles/day; Winthrop chinook test groups were second, averaging 10.4 miles/day; and Lyons Ferry steelhead test groups were the slowest migrators, averaging 5.1 miles/day. The same order was true for the control groups: Wells 9.5 miles/day, Winthrop 5.3 miles/day, and Lyons Ferry 3.8 miles/day.

In comparison to the test groups, all control groups migrated at a slower speed. The Winthrop chinook controls migrated to McNary at about half the speed of test groups (Table 18). The Wells steelhead control groups migrated at two-thirds the speed of test groups. The Lyons Ferry steelhead controls from the second and third releases migrated at three-fourths the speed of test groups, while the first release controls migrated at slightly over half the speed of the test group. This difference would imply that test fish are moving through the control zone (reach below release of control groups) at a substantially faster speed than the control fish. Therefore, the likelihood that control fish are exposed to a higher level of predation in the control zone is high. This would violate the assumption that both test and control groups experience the same mortality level in the control zone. The result would be an over-estimation of survival in the test zone.

4. Recovery Pattern and Proportions

Since mixing of test and control groups was not possible due to the need to release test and control groups simultaneously many miles apart, the passage index is used as the basic statistic to compute survival. The passage indice accounts for differences in sampling rate and project operations (e.g., spill levels), so that test and control recovery numbers are scaled in common terms.

The patterns of recovery of the test and control groups from the three study

TABLE 18 Travel time of 1984 - 1986 survival mark groups from release site to McNary Dam.

Code	<u>1986</u>		<u>1985</u>		<u>1984</u>	
	Travel Time (days)	Speed (mi/day)	Travel Time (days)	Speed (mi/day)	Travel Time (days)	Speed mi/day)
WiT1	28	10.1	33.7	8.4		
WiC1	23	4.6	23	4.6		
WiT2	28	10.1	32	8.8		
WiC2	20	5.3	22	4.8		
WiT3	25	11.3	31	9.1		
WiC3	16	6.6	17	6.2		
WeT1	18	13.4	14	16.6	18	12.9
WeC1	12	8.8	6.7	14.7	6	17.5
WeT2	16	15.1	15	15.5	14	16.6
WeC2	11	9.5	7.3	14.4	6.3	16.7
WeT3	15	16.1	15	15.5		
WeC3	10	10.5	5	21.0		
LyT1	20	5.1	15	6.7		
LyC1	12	3.4	8	5.4		
LyT2	20	5.1	16	6.3		
LyC2	10	4.1	7.7	5.6		
LyT 3	19	5.3				
LyC3	10	4.1				

groups clearly indicate the lack of mixing inherent in the study design. The median passage date for the test and control groups of Winthrop chinook, Wells steelhead, and Lyons Ferry steelhead replicates differed by 5 to 9, 4 to 6, and 6 to 10 days, respectively (Figures 24, 25, and 26). The shape of the recovery cumulative curves for paired test and control groups were very similar for Winthrop Hatchery chinook and Wells Hatchery steelhead. The Lyons Ferry replicates showed a rapid accumulation of control fish recoveries up to the median passage date and thereafter a pattern more similar to test groups. The Lyons Ferry Hatchery control group recovery curve was more similar in shape to that of Wells Hatchery steelhead; whereas its test group recovery curve was more similar in shape to the Winthrop Hatchery chinook. Similarity in passage pattern is not essential though; rather, the project operations and sampling rate differences encountered need to be adequately accounted for in the passage index.

The recovery proportions from the third replicate release of Lyons Ferry and Wells steelhead were much lower than the earlier releases (Table 19). The recovery proportion of the third replicate compared to the average of the earlier two replicates was down 40% for control and 48% for test groups from Wells Hatchery, and down 27% for controls and 23% for test groups from Lyons Ferry Hatchery. Recovery proportions did not decline over time with Winthrop Hatchery replicate releases. In fact, the lowest test recovery was from replicate 2, and the lowest control recovery was from replicate 1. Apparently the last replicate of steelhead at both hatcheries was released later than the optimal release time for best survival, since project operations do not account for the lower proportions recovered. At Wells Hatchery, the release time was typical of later production truck releases out of the ponds. At Lyons Ferry, production fish volitionally migrate from the ponds to the river. Comparisons between recovery distributions of the SMP survival groups and normal production indicate that production fish migrated at the same time as the second replicate.

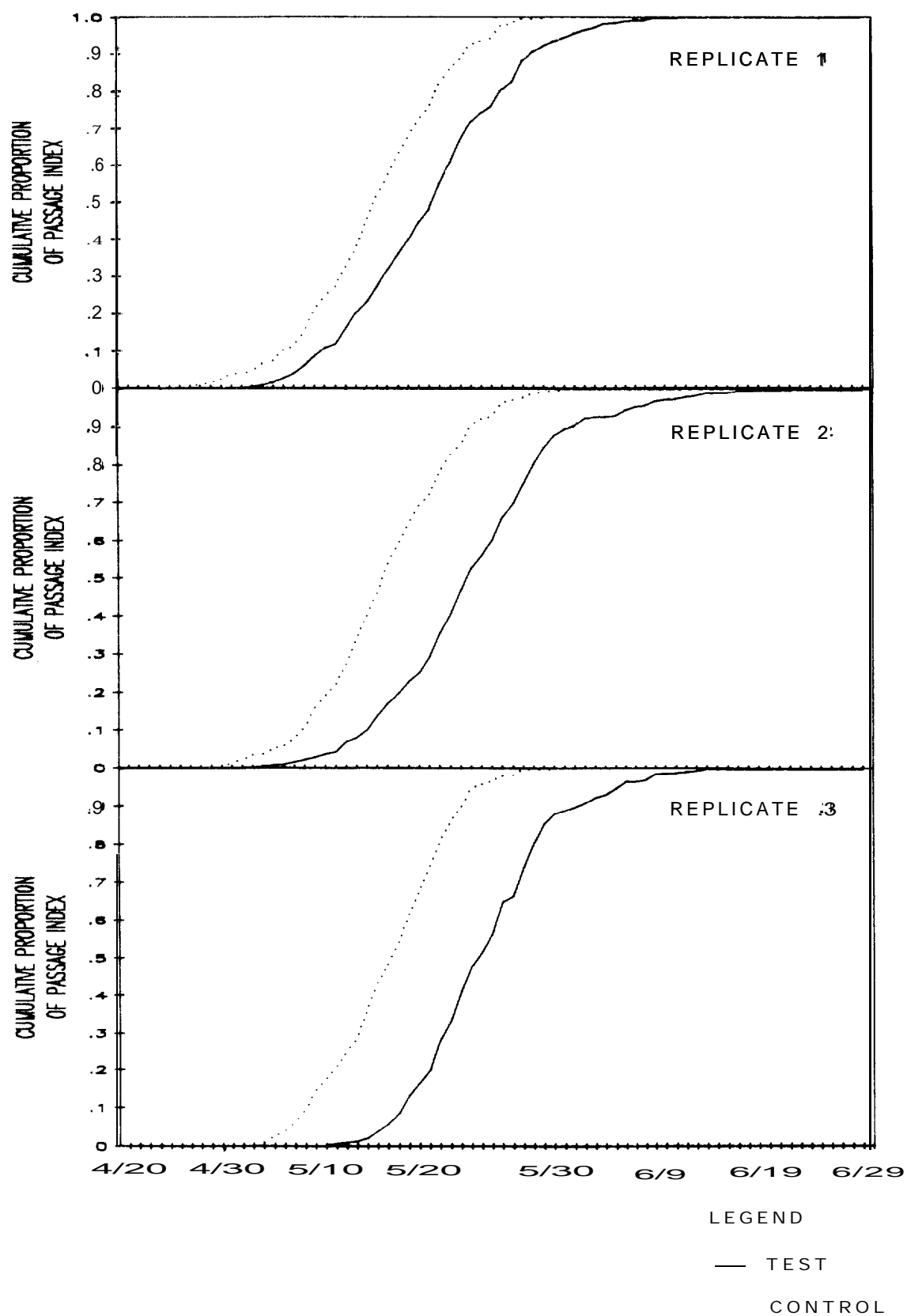


FIGURE 24 Cumulative Mark Recoveries at McNary of Winthrop Spring Chinook, Replicates 1, 2, & 3.

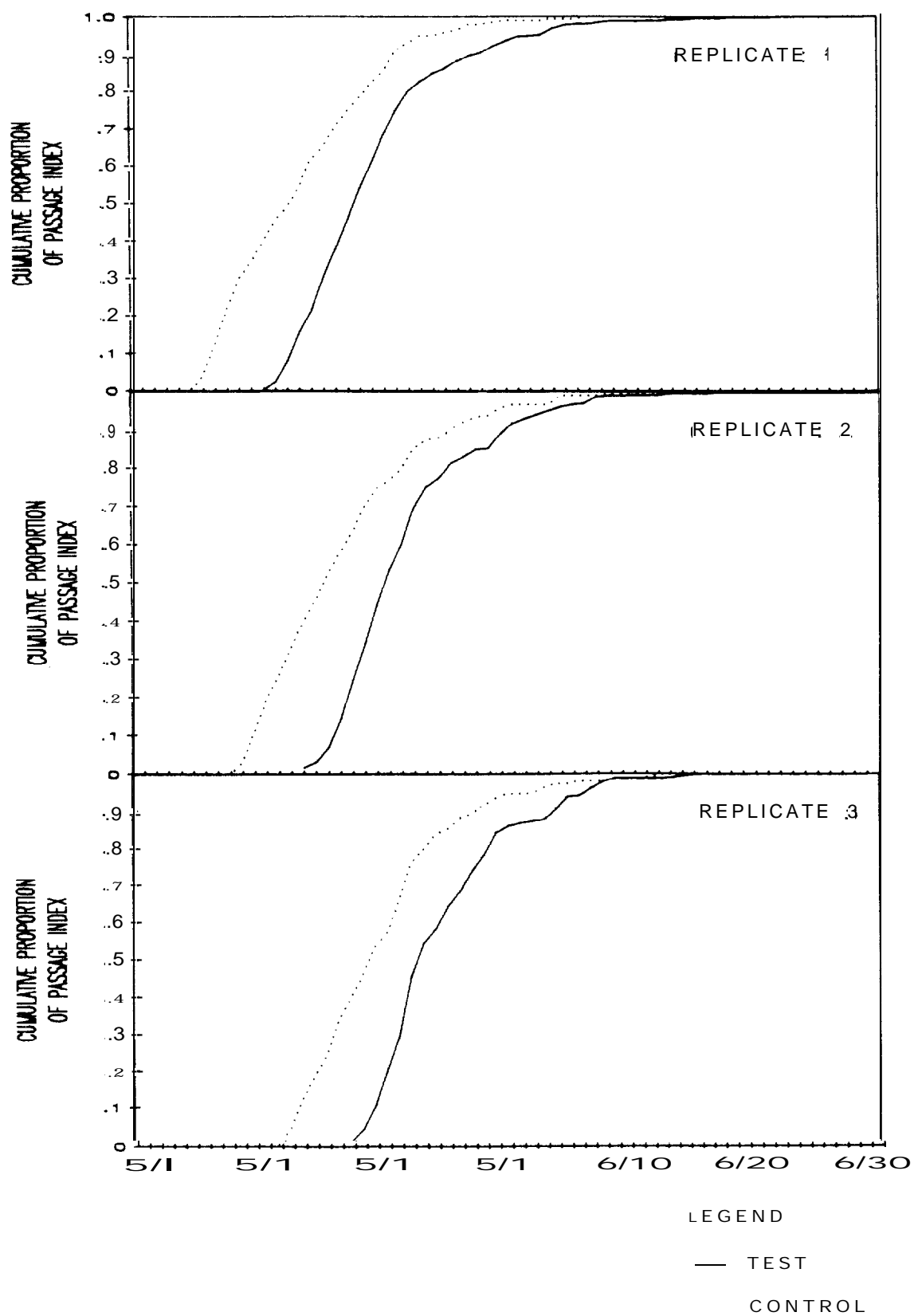


FIGURE 25 Cumulative Mark Recoveries at McNary of Wells Steelhead, Replicates 1, 2, & 3.

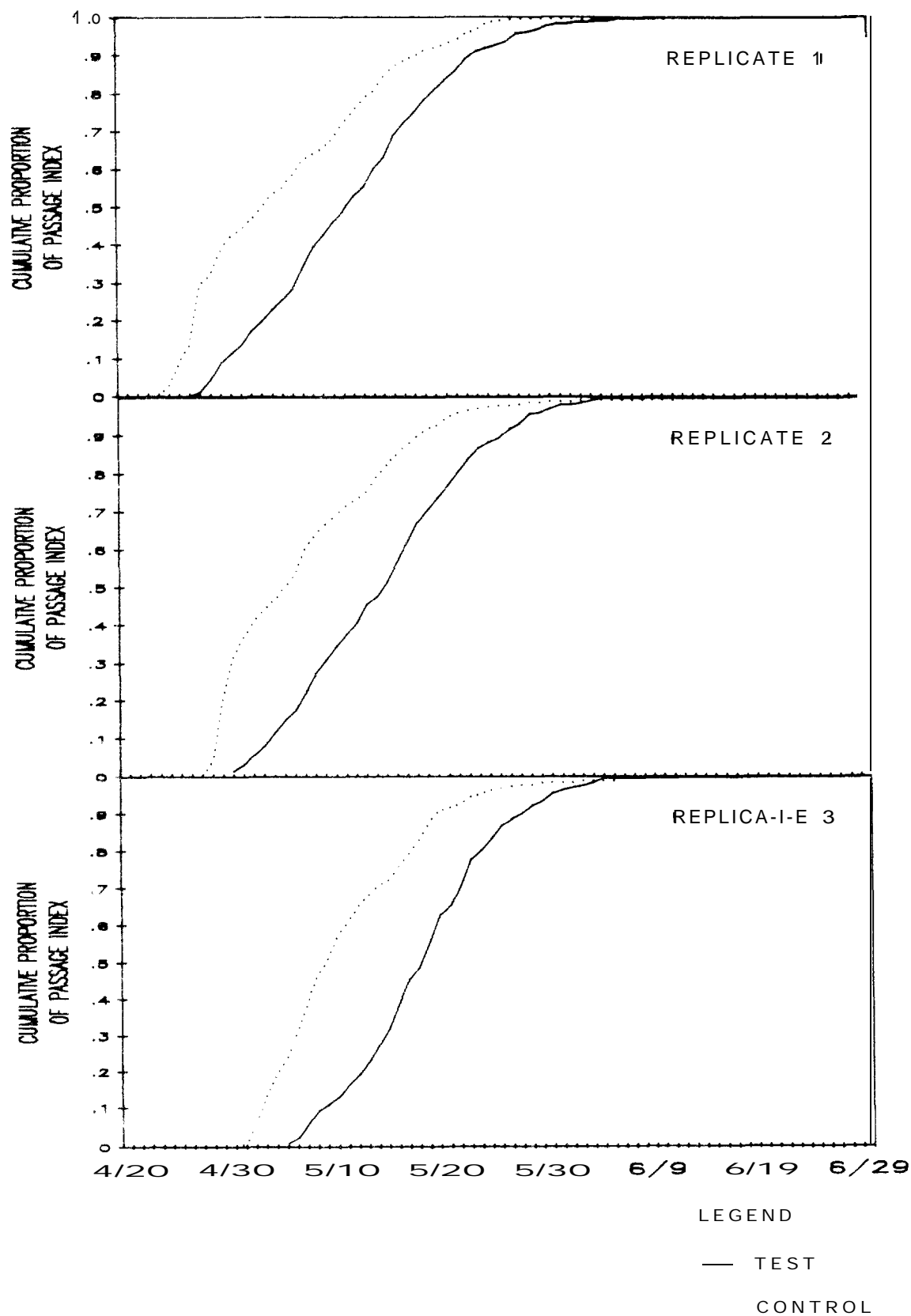


FIGURE 26 Cumulative Mark Recoveries at McNary of Lyons Ferry Steelhead, Replicates 1, 2, & 3.

TABLE 19 McNary Dam brand recovery data for 1986 smolt survival monitoring groups.

<u>Hatchery</u>	<u>Code</u>	Median Passage <u>Date</u>	<u>Sample</u>	<u>Collection</u>	<u>Index</u>	<u>Expanded Proportion</u>
Winthrop	WiT1	19-May	792	7,740	9,413	0.2731
	WiC1	14-May	513	4,947	5,643	0.4702

Winthrop	WiT2	23-May	546	5,498	6,979	0.2024
	wiC2	15-May	588	5,714	6,568	0.5478

Winthrop	WiT3	24-May	625	6,396	8,292	0.2414
	WiC3	15-May	586	5,583	6,343	0.5328

Wells	WeT1	19-May	645	6,478	7,677	0.2607
	WeC1	13-May	376	3,423	3,922	0.3329

Wells	WeT2	21-May	498	5,009	6,129	0.2040
	WeC2	16-May	274	2,758	3,202	0.2766

Wells	WeT3	23-May	262	2,658	3,617	0.1206
	WeC3	19-May	184	1,853	2,229	0.1866

Lyons Ferry	LyT1	11-May	670	6,382	7,313	0.3650
	LyC1	05-May	323	3,148	3,630	0.3026

Lyons Ferry	LyT2	15-May	623	5,853	6,734	0.3356
	LyC2	05-May	409	4,018	4,551	0.3782

Lyons Ferry	LyT3	18-May	468	4,540	5,390	0.2686
	LyC3	09-May	324	2,854	3,144	0.2616

Speed of the migration did not decline over time, but instead showed a slight increase over time for all groups (Table 18). Apparently later releases may have been at a higher smoltification level at time of release, and therefore migrated faster to McNary Dam. On the other hand, the last replicates may have been more stressed at release, and therefore survived less than the earlier releases based on proportions recovered.

5. Survival Estimates

Survival of Winthrop spring chinook averaged 46.8% for the three replicates, and ranged from 36.9% to 58.1% (Table 20). The 95% confidence interval about the mean puts the population survival within the interval of 20 to 73%. Very similar results were observed in 1985, when an average of 45% survival and 95% confidence interval of 23 to 67% survival was obtained (Table 21).

Survival of Wells steelhead averaged 72.2% for the complete data set, and ranged from 64.6% to 78.3% for individual replicates (Table 20). The 95% confidence interval about the mean puts the population survival within the interval of 55 to 90%. This year's average survival was slightly higher than that in 1985 and the 95% confidence interval was shorter this year (Table 21). In 1985, the average survival estimate was 65%, and the 95% confidence interval was 39 to 91% survival.

For two of the three Lyons Ferry steelhead replicates, survival was calculated in excess of 100% (Table 20). This is the result of control groups being recovered at McNary at a lower rate than the test groups. This occurrence is obviously improbable, and indicated possible assumption violations. The same improbable results were observed in 1985 (Table 21). Several possible explanations for these results are discussed in Section V.

*TABLE 20 Calculated survival of test groups from the 1986
Smolt Monitoring Program.

<u>Group</u>	<u>Survival</u>	<u>Std. Error*</u>	<u>95% C.I.</u>	<u>Lower Bound</u>	<u>Upper Bound</u>
<u>Winthrop Spring Chinook</u>					
WiT1	0.581	0.030	to. 059	0.522	0.640
WIT2	0.369	0.020	20.039	0.330	0.408
WIT3	0.453	0.023	+0.046	0.407	0.499

Average	0.468	0.0616	+0.265	0.203	0.733
<u>Wells Steelhead</u>					
WeT1	0.783	0.048	20.094	0.689	0.877
WeT2	0.738	0.050	+0.098	0.640	0.836
WeT3	0.646	0.055	+o.107	0.539	0.753

Average	0.722	0.0403	+0.173	0.549	0.895
<u>Lyons Ferry Steelhead</u>					
LyT1	1.206	N/A			
LyT2	0.887	0.053	+0.103	0.784	0.990
LyT3	1.027	N/A			

Average	N/A	N/A	N/A		

*
Expanded proportions shown in Table 19 divided by factor of 10 before
computation of estimate of variance.

TABLE 21 Comparison of 1985 and 1986 Survival Estimates and Associated Flow.

Lower Snake River: (60 miles, 2 dams, 2 reservoirs)

	1985	1986
Steelhead (Lyons Ferry)		
Rep 1	>1.0	>1.0
Rep 2	>1.0	0.89
Rep 3)1.0
Mean	N/A	N/A

Mid-Columbia Reach: (8-45 miles Methow, 127 miles Columbia, 5 dams, ~~4~~¹/₂ reservoirs)

	1985	1986
Steelhead (Wells)		
Rep 1	.65	.78
Rep 2	.75	.74
Rep 3	.54	.65
Mean	0.65±0.26	0.72±0.17

Flow* 130 kcfs 144 kcfs

Spring Chinook (Winthrop)

Rep 1	.55	.58
Rep 2	.41	.37
Rep 3	.39	.45
Mean	0.45±0.22	0.47±0.27

Flow* 137 kcfs 132 kcfs

* Flow is the average of the three replicate test groups' associated average river flow for the 7 days around the 50% passage date at Rock Island.

V. DISCUSSION

A. Passage Indices

Passage indices, which provide a measure of run magnitude, are comparable with prior years for a given species at a particular project. This is true to the extent that collection efficiency remains relatively constant among years. The high collection of sub-yearling chinook at Rock Island in 1986 may be influenced by the high spring flows causing larger numbers of small wild sub-yearling chinook to be present and to enter the orifices than in 1985, when flows were Power. High spill levels would result in large expansions to an already inflated collection relative to 1985, so that the 200% passage index increase from 1985 to 1986 may actually be much lower.

Another factor that can affect the estimate of a passage index is the extent to which the passage index adjustment does not adequately account for passage through spill. This adjustment assumes that passage through the powerhouse and spill is proportional to flow. Rock Island's spill efficiency tests conducted in 1984 indicated that more yearling chinook may pass through spill than the passage index adjustment allocates (Steve Hayes, Chelan PUD, personal communication). From April 24 through June 2, approximately 27% of yearling chinook passed through 15% of spill at Rock Island. This suggests that 16% more yearling chinook should be accounted for in the passage index. Since spill lasted a longer period in 1986 than in 1985, the underestimating of a passage index would be greater in 1986. This means that the 33% difference between the two years stated in the results section may be closer to a 22% difference. These examples have been provided to show what passage index values are influenced by changing FGE and spill effectiveness levels at a given project, and comparisons among years must take this into account.

B. Travel Time

The accuracy of travel time determination is dependent upon the distribution of the brand recoveries at the upstream and downstream projects around the reach of interest. Often a sample size of 50 or more would give a reasonable distribution,

but occasionally a brand group with several hundred fish recovered has an erratic recovery pattern, and subsequent travel time estimates appear questionable.

The greatest difficulty in determining what would appear as a reasonable travel time estimate has been in John Day pool. Three brand groups of yearling chinook and 11 brand groups of steelhead had travel times of 1 day or less between McNary and John Day dams. It is unlikely that yearling chinook and steelhead smolts would travel 76 miles through a reservoir in a day or less.

How fish pass McNary and become part of the sample there may help explain why short travel time estimates are obtained for John Day pool. Only fish passing through the bypass system have the opportunity to be sampled. There can be a delay in travel through the bypass system and out of the wet separator that is not experienced by fish passing the project through spill bays or turbine units. With FGE levels in excess of 70% at McNary for yearling chinook and steelhead, the majority of fish would pass through either the bypass system or spill bays, rather than through turbine units. Little delay would be expected of those fish passing through spill. Approximately half of the steelhead entering the bypass system would be transported, thus avoiding John Day. Therefore, one would expect the greatest chance for abnormal travel time estimates to be during steelhead migration, when spill levels are higher and more fish are transported.

In 1986, none of the steelhead groups from the mid-Columbia provided realistic travel time estimates for John Day pool. These migrants may be more susceptible to passage through spill if they follow the Washington side of the Columbia below the confluence with the Snake River. If the fish passing through spill arrive earlier at John Day than the bypassed fish, and a large percentage of the bypassed fish are removed for transportation, then the result would be an earlier arrival distribution at John Day than if all fish had passed McNary the same way and experienced no transportation removals.

The Passive Integrated Transponder (PIT) tag evaluation study provided another group of spring chinook and steelhead which could be compared to SMP travel time results. Juvenile spring chinook (N=2450) and steelhead (N=2437) were marked at Dworshak National Fish Hatchery with PIT tags to evaluate travel time of the PIT tag groups compared to freeze branded chinook (N=40,675) and steelhead (N=35,025) groups marked at the same hatchery. For each species, PIT tagged and freeze branded groups were released the same date. Since the actual hour of recovery of PIT tagged fish is known, the recovery date of PIT tagged fish was adjusted to correspond to a 24-hour sample period beginning at 7am at Lower Granite and noon at McNary. Figures 27 and 28 show the arrival dates and daily passage index proportions of the PIT and freeze brand groups at both projects. Median travel dates for both chinook and steelhead mark groups are listed below:

	<u>Lower Granite</u>	<u>McNary</u>	<u>Travel Time(days)</u>
	<u>Date</u>	<u>Date</u>	
<u>Chinook</u>			
FB	4/21	5/11	20
PIT	4/22	5/5	13
<u>Steelhead</u>			
FB	5/17	5/26	9
PIT	5/16	5/27	11

The travel time of both the freeze brand and PIT tag groups showed nearly similar arrival times at Lower Granite for both yearling chinook and steelhead. The travel time of these same groups was measured from Lower Granite to McNary Dam, a distance of 140 miles. The PIT tagged chinook had a travel time estimate of 13 days compared to 20 days for the freeze branded group. The PIT tagged steelhead had a travel time estimate of 11 days which compared favorably to the 9 day estimate for the freeze brand group. It is not clear why the large discrepancy occurred for spring chinook in the timing of the recovery distribution at McNary. In addition, PIT tagged groups were recovered in greater proportion than were the freeze branded groups at both sampling sites. This may be because of freeze brands being missed, sampling anomalies, or other conditions occurring within the river that may affect one group more than the other.

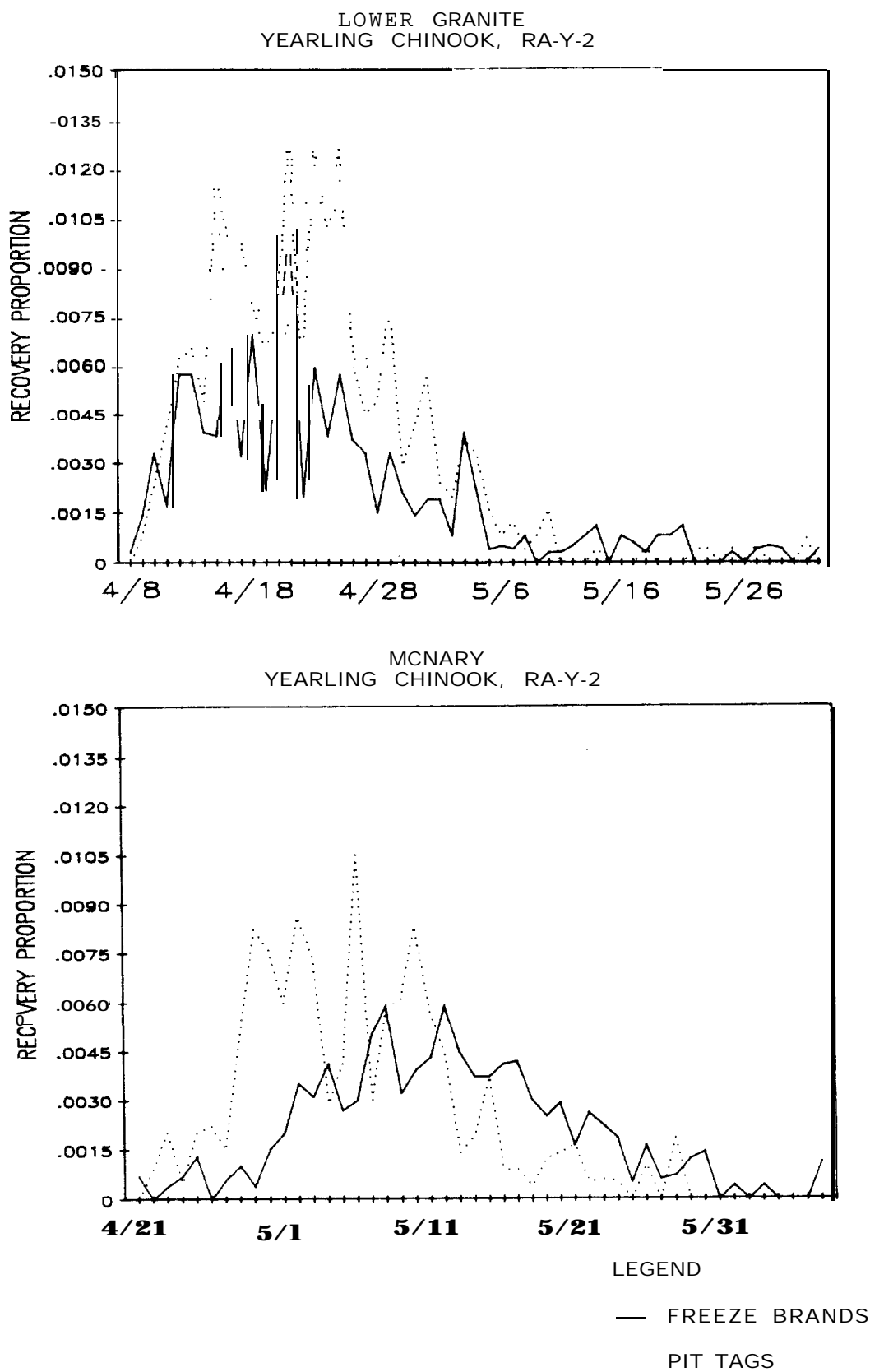
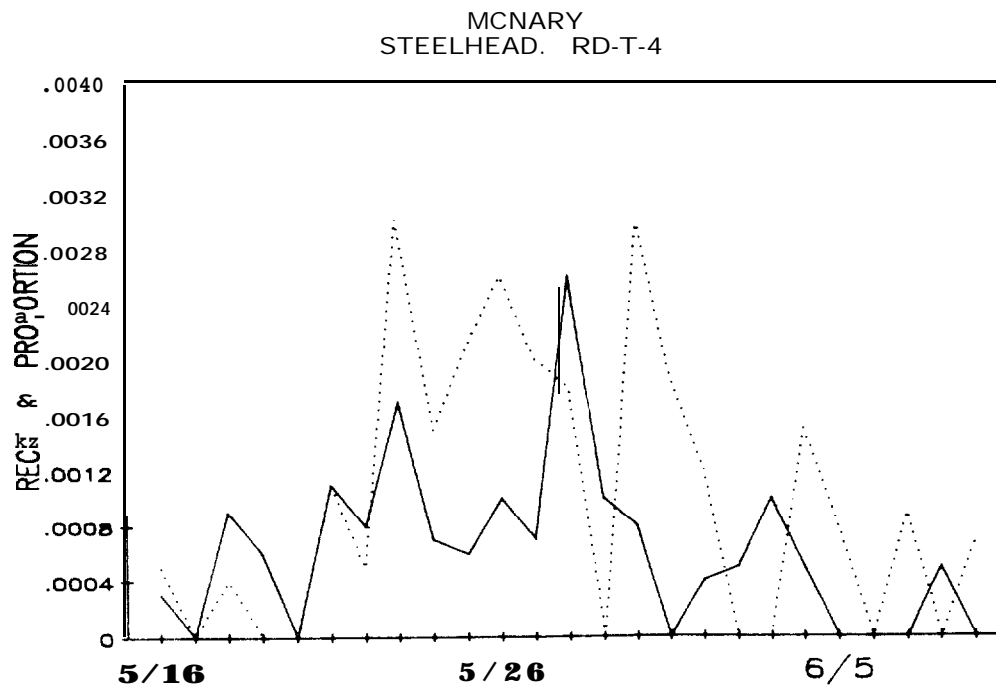
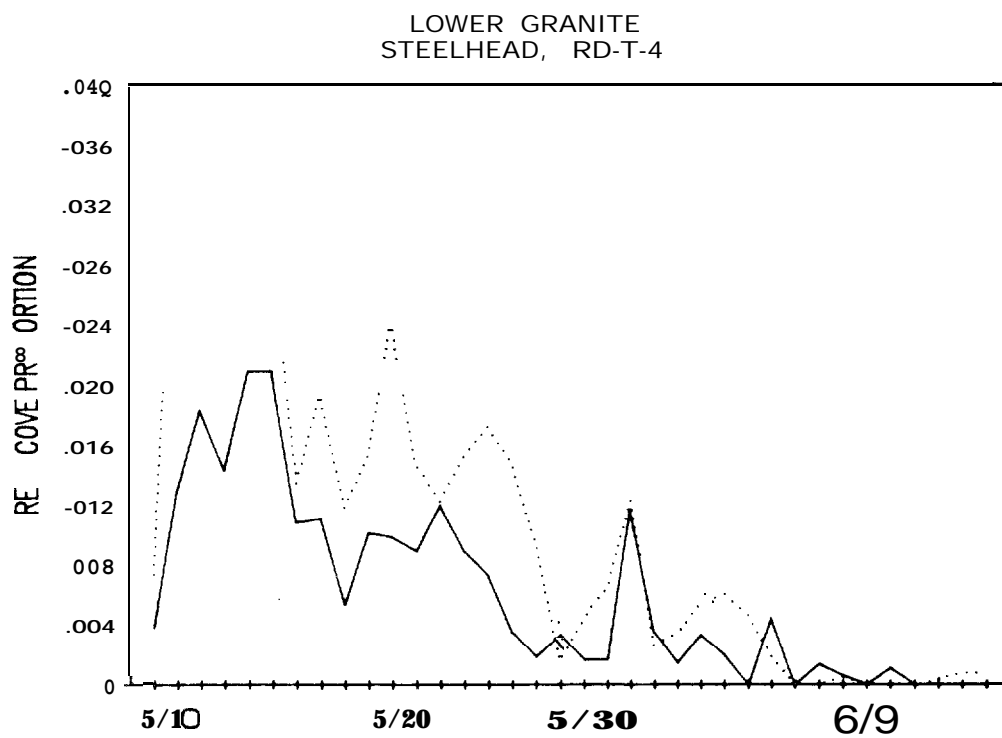


FIGURE 27 Comparison of Recovery Proportions of Freeze Branded and Pit Tagged Dworshak Hatchery Spring Chinook.



LEGEND

— FREEZE BRANDS

... PIT TAGS

FIGURE 28 Comparison of Recovery Proportions of Freeze Branded and Pit Tagged Dworshak Hatchery Steelhead.

A comparison of travel time from Lower Granite to John Day among the three years of the Smolt Monitoring Program under varying flows did not show consistent results (Table 22). 'It is apparent that large fluctuations in flow will show differences in travel time, whereas small flow fluctuations may not. The higher flows of 1984 showed faster travel time estimates than the succeeding *two* years which had similar average to below average flows. However, not all hatchery releases behaved similarly. Dworshak spring chinook and steelhead data indicate faster travel time in 1985, the year with the lowest of the three flows. Additional monitoring of groups at release may indicate different physiological conditions that may have an influence on travel time.

In the preceding analysis, travel time from Lower Granite to John Day was computed so that a further comparison to the 1973 to 1983 period investigated by Sims, et.al.(1984) could be made. In most instances, the 4-day average yearling chinook travel time estimate in John Day pool was added to the respective estimates between Lower Granite and McNary, and in all cases the 2-day average steelhead travel time estimate was used for the John Day pool component. For the 1984-1986 data points, comparable average flows were calculated based on a 15-day interval about the median passage date, rather than about the peak passage date as indicated in Sims, et.al.(1984).

The 1984-1986 yearling chinook and steelhead travel time data compared favorably with the 1973-1983 results. Average travel time per project plotted against average flow shows 1984 - 1986 data following a common relationship with the data from earlier years (Figure 29). The average flows for 1984 - 1986 were above 85 kcfs, a region where smaller incremental reductions in travel time are produced with increasing flows. This coupled with the variability around the flow to travel time per project relationship may help explain why flow to travel time relationships were not definitive for the 1984 - 1986 data alone.

TABLE 22 Comparison of Flow and Travel Time of Yearling Chinook and Steelhead from Lower Granite to John Day, 1984-1986.

LOWER GRANITE TO JOHN DAY CHINOOK DATA

RIGIN	50% PASSAGE DATE 1986				50% PASSAGE DATE 1985				50% PASSAGE DATE 1984			
	LGR	JDA (OR MCN)	TRAVEL TIME	FLOW	LGR	MCN	TRAVEL TIME *	FLOW	LGR	MCN	TRAVEL TIME *	FLOW
AMTOOTH	23-Apr	02-May *	13	95.22	04-May	16-May	16	80.11	06-May	18-May	16	143.23
F. SALMON R.	02-May	15-May *	17	97.35	14-May	26-May	16	92.97	15-May	23-May	12	175.28
APID RIVER	19-Apr	07-May	18	94.53	25-Apr	08-May	17	78.92	28-Apr	07-May	13	109.75
ELLS CANYON	16-Apr	02-May	16	95.20	13-Apr	28-Apr	19	92.74	18-Apr	27-Apr	13	128.96
WORSKAK	21-Apr	12-May	21	98.29	27-Apr	09-May	16	79.72			N/A	
AVERAGE			17	96			17	85			14	139

MCN 50% PASSAGE DATE, 4 DAYS WERE ADDED TO TRAVEL TIME

LOW CALCULATED USING + & - 7 DAYS AROUND MEDIAN PASSAGE DATE AT ICE HARBOR DAM

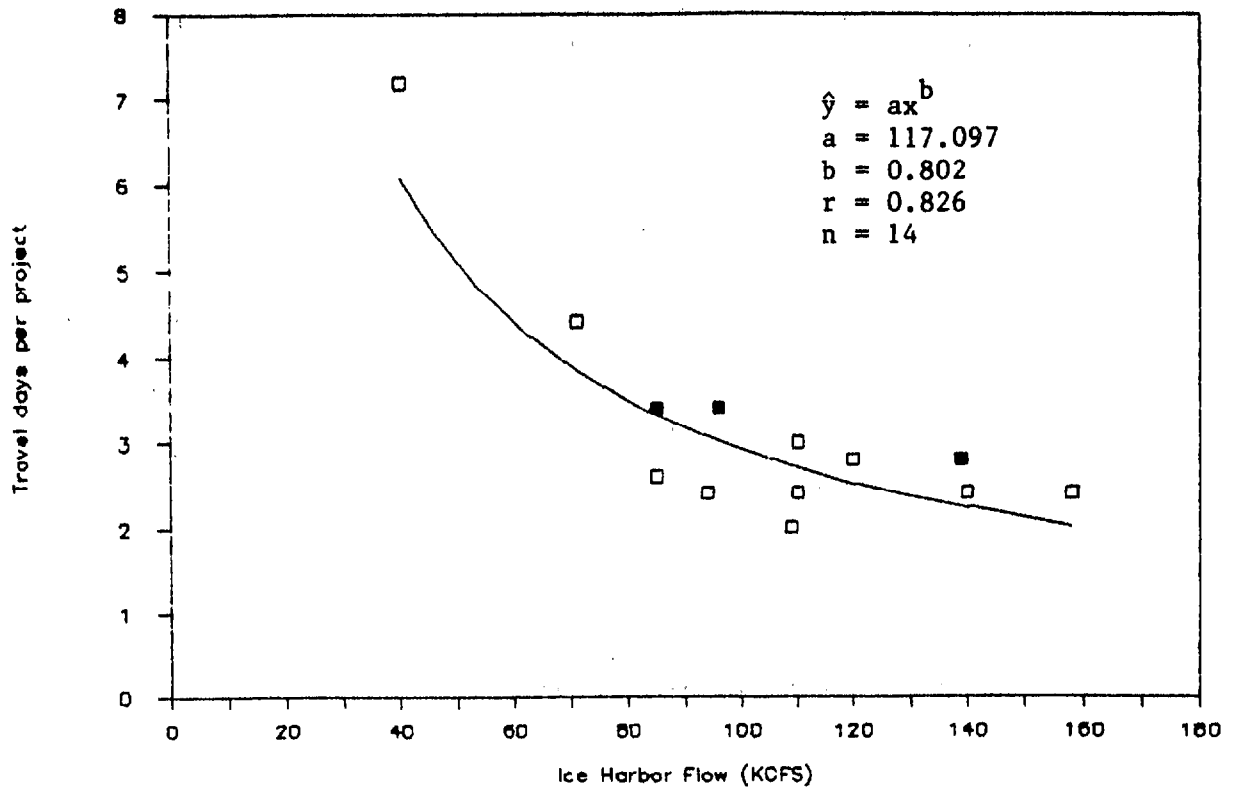
LOWER GRANITE TO JOHN DAY STEELHEAD DATA

RIGIN	50% PASSAGE DATE 1986				50% PASSAGE DATE 1985				50% PASSAGE DATE 1984			
	LGR	MCN	TRAVEL TIME *	FLOW	LGR	MCN	TRAVEL TIME *	FLOW	LGR	MCN	TRAVEL TIME *	FLOW
RANDE RONDE	20-May	27-May	12	137.85	21-May	02-Jun	14	102.18	N/A	N/A	N/A	
WORSKAK	17-May	26-May	11	114.87	04-May	11-May	9	82.28	12-May	20-May	10	163.82
AVERAGE			12	126			12	92			10	164

MCN 50% PASSAGE DATE, 2 DAYS WERE ADDED TO THE TRAVEL TIME

LOW CALCULATED USING + & - 7 DAYS AROUND MEDIAN PASSAGE DATE AT ICE HARBOR DAM

YEARLING CHINOOK



1984 - 1986 data points are shaded

STEELHEAD

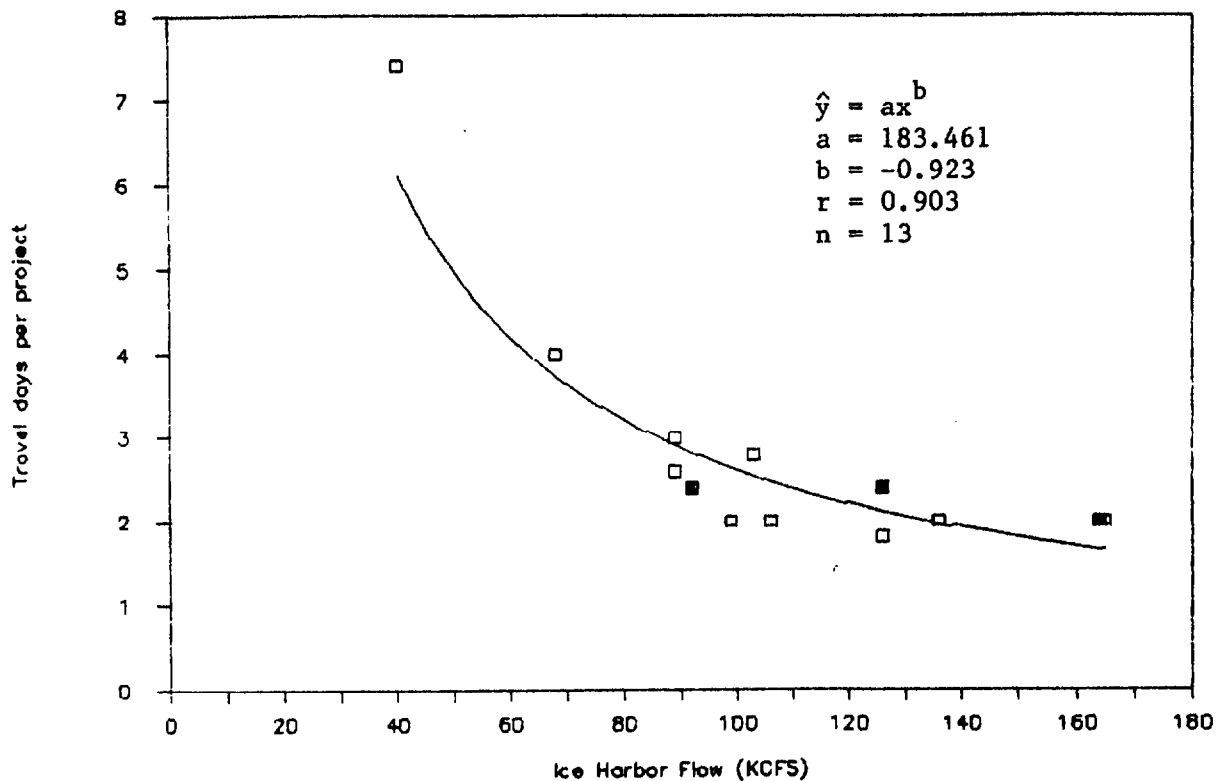


FIGURE 29 Relationship of Chinook Salmon and Steelhead per Project Travel Time and River Flow at Ice Harbor, 1973-1986.

C. Survival Studies

A set of questions was listed in Table 15 of Section IV to aid in assessing reliability of data used in survival estimation. This list addressed several key assumptions inherent in the survival design that must be met in order to obtain unbiased estimates of survival. These assumptions are (a) equality of recovery rates between test and control groups; and (b) equality of pre-release treatment of test and control groups and equality of behavioral response of both groups after release.

The latter assumptions were investigated by comparing length distributions and fish quality of test and control groups prior to release, and looking for declining recovery rates and migration speeds of control groups over time. The length distributions were not significantly different in all replicates except for two, and in those instances the significant length difference between groups was only 4mm. As stated earlier, it is felt that these small length differences would not have any effect on the survival estimation. Upon release from Winthrop, Wells, and Lyons Ferry hatcheries the study fish appeared healthy based on visual observation. Brand burning was very light at Wells Hatchery this year. Wells steelhead appeared more smolted than Lyons Ferry steelhead at release. This may account for the residualism observed in Lyons Ferry steelhead.

The migration speed of control groups was much slower than that of test groups in general. Since control and test fish for a given replicate are released the same day and presumably at the same smoltification level, their migration speed from release to recovery sites should be fairly similar. Given the observed pattern of slower to faster migration speeds as brand groups move downstream, the test fish would undoubtedly be migrating faster than the control fish when they reach the control zone (i.e., river reach from control group release to recovery site). They potentially would be exposed to less predation in the control zone due to less duration in that zone. This could result in an overestimation of survival.

However, the slower migrating Winthrop control groups may not be experiencing greater mortality than the test groups in the control zone based on indirect comparisons with in-river marked groups. The SMP control groups migrated to McNary 60% slower than in-river branded spring chinook released at Priest Rapids. The proportion of these hatchery and in-river groups recovered at McNary and John Day was nearly identical, indicating similar relative survival (Table 23). No in-river steelhead groups were available for comparison with the Wells and Lyons Ferry control groups.

Since smoltification levels often intensify after release (Rondorf et.al., 1985) and a period of migration in the river, the assumption of behavioral similarity between test and control groups may change dramatically by the time the test fish are in the control zone and both test and control groups are passing the recovery site. Because of this potential impact on the design assumptions, an added objective of the 1987 SMP looks at smoltification levels of test and control groups at time of release and time of recovery.

In addition, stress will be investigated in the 1987 SMP at time of release, since test and control groups do not experience the same degree of transportation time to the release sites. Winthrop spring chinook controls are trucked 3.5 hours to below Priest Rapids Dam, whereas the test fish are not trucked at all. Wells steelhead controls are trucked 2.5 hours to the same site, whereas test fish are trucked only 0.5 hours. Lyons Ferry steelhead controls are trucked 90 minutes to below Ice Harbor Dam, whereas test fish were trucked only 20 minutes to below Little Goose Dam. Therefore, different stress levels may be experienced by test and control groups. The migration speed differential between test and control groups is greatest for Winthrop spring chinook, next for Wells steelhead, and least for Lyons Ferry steelhead. This is the same order obtained for the differential between test and control groups in trucking time to the release site.

TABLE 23 Percentage branded spring chinook recovered at Rock Island, McNary, and John Day Dams.

Group	Brand	Release	Release	Percentage Recovered			JDA Date	
		Number	Date	RIS	MCN	JDA	50%	Passage
<u>Winthrop</u>								
WiT1	RA-7c-1	34466	4/21	0.49	27.3	6.2		5/21
WiC1	LA-7C-3	12001	4/21	--	47.1	19.9		5/18
WiT2	RA-7c-3	34485	4/25	0.38	20.3	5.7		5/25
WiC2	LA-7C-1	11989	4/25	--	54.9	19.5		5/18
WiT3	RA-7T-3	34353	4/29	0.39	24.1	5.6		5/25
WiC3	LA- 7U- 1	11904	4/29	--	53.2	22.0		5/19
 <u>Leavenworth</u>								
	LA-7T-1	40602	4/23	0.77	30.5	8.2		5/23
 <u>In-River Priest Rapids Releases</u>								
	LA-RH-1	9464	4/23-5/3	- -	53.5	24.8		5/17
	LA- RR- 1	10438	4/24-5/2	--	42.0	18.8		5/18
	LA-RH- 2	12473	5/5-11	--	48.9	25.2		5/20
	LA-RR- 2	8898	5/5-8	--	52.4	28.6		5/20
	LA-RH- 3	7880	5/12-18	--	67.9	16.2		5/24
	LA- RR- 3	5250	5/12-16	--	49.3	18.9		5/23
	LA-RH-4	5113	5/20-25	--	48.9	15.9		5/30
	LA-RR-4	1521	5/19-23	--	45.9	18.6		5/29
 <u>In-River McNary Releases</u>								
	LA-15-3	5620	4/17-5/15	--	--	15.1		5/8
	LA- 1 V- 3	5054	5/6-7	--	--	14.9		5/11
	LA- 1D- 3	5168	5/7-9	---	--	20.3		5/13
	LA- 1M- 3	5239	5/9-11	--	--	19.7		5/15
	LA- 1 F- 3	5329	5/11-12	--	--	19.2		5/16
	LA- 1D- 1	5113	5/17-20	--	--	20.2		5/23
	LA 1 M- 1	5079	5/30-24	--	--	15.1		5/28

The last replicate of both Wells and Lyons Ferry steelhead releases showed a decline in proportion recovered. This may be due to added stress experienced by these fish which may be more smolted due to the later release date. Since the test group also experiences the reduced recovery rate, the impact of this added mortality factor on the survival estimates appears minor. In-river branded steelhead released below Little Goose also exhibited a decline in recovery proportion at McNary and John Day over time (Table 24). The lower proportion of Lyons Ferry test groups recovered relative to the in-river groups may be a function of residualism and initial hatchery related mortality.

The recovery proportion of Lyons Ferry steelhead control groups is lower than that of test groups for 2 of the 3 replicates, resulting in survival estimates in the test zone greater than 100%. Either control fish are subjected to higher predation in the control zone than test fish, residualism is higher for the control groups, or the collection efficiency of control fish is lower at McNary than that of test fish, or a combination of all.

One explanation that has been suggested for the Lyons Ferry survival results is that the control fish encountered unusual concentrations of predators near the release point. Past studies have shown that concentrations of predators can be present in the tailrace of hyroelectric projects (Sims et.al, 1976-1978). This hypothesis was tested by having the release location of the control groups on the other side of the river from where they were released in 1985. Release location did not appear to make any difference. It may be that control fish, being concentrated together and disoriented immediately after release, are more susceptible to predators than actively migrating test fish below Ice Harbor.

Another explanation is that there is a higher level of residualism in McNary pool of control fish than is experienced by test fish above Ice Harbor Dam. If test fish become hold-avers in the test zone, the results would appear as increased

TABLE 24 Percentage branded steelhead recovered at Rock Island, McNary,
and John Day Dams.

Group	Brand	Release Number	Release Date	Percentage Recovered			JDA Date	
				RIS	MCN	JDA	50%	Passage
Wells								
WeT1	LA-7N-1	29451	5/1	2.7	26.0	12.3		5/19
WeC1	RA--iP-1	11780	5/1	--	33.2	24.8		5/14
WeT2	LA-7N-3	30046	5/5	2.5	20.6	8.1		5/22
WeC2	RA-7P-3	11575	5/5	--	27.5	20.5		5/15
WeT3	LD-7N-1	29992	5/9	1.0	11.9	4.0		5/24
WeC3	RD-7P-1	11943	5/9	--	18.7	14.4		5/20
Lyons Ferry								
LyT1	RA-7F-1	30035	4/21	--	36.6	21.2		5/13
LyC1	LA-7U-1	11998	4/21	--	33.0	25.7		5/2
LyT2	RA-7F-3	20063	4/25	--	33.7	18.5		5/16
LyC2	LA-7U-3	12034	4/25	--	37.8	25.8		5/7
LyT3	RD-7F-1	20069	4/29	--	26.9	11.5		5/17
LyC3	LD-7U-1	12018	4/29	--	25.8	13.5		5/10
In-River Little Goose Releases								
	LA-P-1	4319	4/15-27	--	50.3	32.1		5/4
	LA-P-2	4176	4/29-5/1	--	51.6	29.5		5/9
	LA-P-3	4964	5/1-8	--	46.6	31.5		5/15
	LA-P-4	4150	5/8-13	--	51.7	22.9		5/21
	LA-W-1	4249	5/13-17	--	53.3	21.3		5/24
	LA-Y-2	4250	5/17-22	--	46.6	15.5		5/29
	LA-W-3	4250	5/22-27	--	36.0	14.9		5/31
	LA-W-4	1.287	5/27	--	46.5	none		

mortality in the test reach. If an equal proportion of control fish become hold-overs in the control zone, the impacts of holding over would cancel out. About 1.1% of Lyons Ferry test and 0.2% Lyons Ferry control fish from the 1985 survival study releases passed McNary early in 1986. It is unknown what proportion of Lyons Ferry fish actually were holdovers, since what is observed in the spring of 1986 is only those fish surviving the additional year in the reservoirs above McNary.

The amount of residualism in the 1986 Lyons Ferry Hatchery releases is equally unknown, but it could be a significant proportion. One-third of the steelhead collected at Lower Monumental after August 1, 1986, were from Lyons Ferry Hatchery. Virtually all of the hatchery production released on-site and below Little Goose Dam as part of the FPC survival studies were branded. A higher proportion of fish from the first and third survival test releases were recovered than from the second survival test release. This second test release matched the migration period of the production release most closely. The second replicate group did not have an estimate of survival in excess of 100 percent.

The third explanation of different collection efficiency of test and controls at McNary will be discussed next. This discussion applies to Winthrop and Wells groups in addition to Lyons Ferry groups. The survival design assumes that the recovery rates of test and control fish are equal at McNary. But before investigating this assumption of equality of recovery rates (i.e., equal collection efficiency), it is safe to conclude that behavioral difference between test and control groups have occurred. These differences could create differential survival in the control zone between test and control groups, thus causing the potential for over-estimating survival in the test reach. These behavioral differences could also influence the recovery rate at McNary.

The issue of whether collection efficiency of the two groups is different may best be investigated by comparing recovery proportions observed at McNary to those

downstream at John Day. This comparison requires several assumptions pertaining to mortality in John Day pool and collection efficiency at John Day. For this analysis, additional assumptions are made: (1) test and control groups experience the same mortality rate in John Day pool; (2) the same collection efficiency at John Day Dam; and (3) similar proportions removed for transportation at McNary. Nevertheless, this approach can provide insight into how test and control groups are recovered at McNary.

First, several potential scenerios are presented:

- (1) If survival in the control zone is the same for test and control groups and the collection efficiency at McNary is the same, survival estimates based on McNary and John Day recoveries should be very close.
- (ii) If survival in the control zone is lower for control than test fish and collection efficiency the same, the observed recovery proportion of controls at McNary and John Day would be lower than expected from (i). An overestimation of test reach survival would result.
- (iii) If survival in the control zone is equal among test and control groups and the collection efficiency of control groups is lower at McNary, the observed recovery proportion of controls would be lower than expected from (i) at McNary and higher than expected from (i) at John Day. An overestimate of test reach survival would occur based on McNary recoveries and an underestimate would occur based on John Day recoveries.

Proportions of test and control fish from Winthrop, Wells, and Lyons Ferry hatcheries recovered at McNary and John Day dams result in survival estimates that are lower at John Day in all cases (Table 25). If all assumptions are being met, both recovery sites should produce similar survival estimates for the test reach. Determining which assumptions are being violated is not a simple task;

TABLE 25 Test reach survival estimates based on McNary versus John Day test and control recovery proportions.

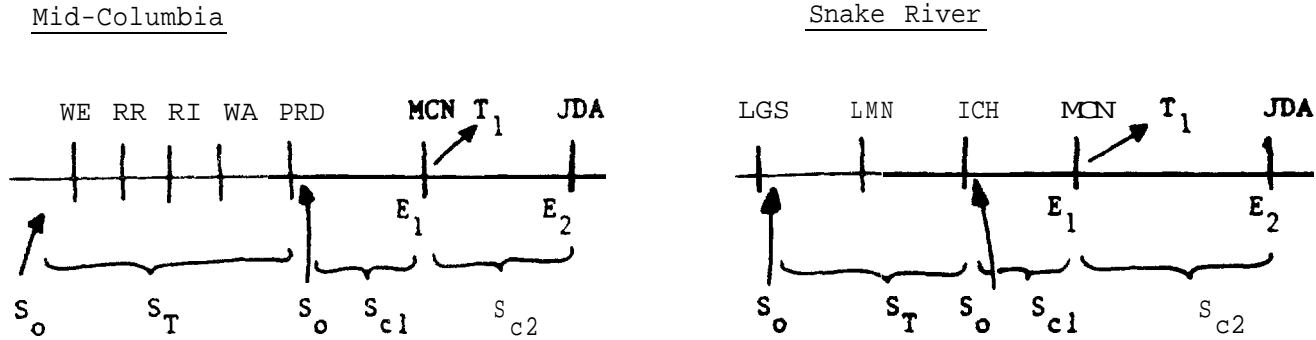
<u>Group</u>	<u>Replicate</u>	<u>McNary</u>			<u>John Day</u>		
		<u>Proportion</u>	<u>Survival</u>	<u>Estimate</u>	<u>Proportion</u>	<u>Survival</u>	<u>Estimate</u>
		<u>Test</u>	<u>Control</u>		<u>Test</u>	<u>Control</u>	
Winthrop	1	.2735	.4694	.583	.0623	.1985	.314
	2	.2029	.5489	.370	.0568	.1953	.291
	3	<u>.2394</u>	<u>.5280</u>	<u>.454</u>	<u>.0564</u>	<u>.2203</u>	<u>.256</u>
	Average	.239	.515	.469	.059	.205	.287
Wells	1	.2603	.3308	.787	.1233	.2484	.496
	2	.2040	.2751	.742	.0812	.2046	.397
	3	<u>.1206</u>	<u>.1857</u>	<u>.649</u>	<u>.0399</u>	<u>.1442</u>	<u>.277</u>
	Average	.195	.264	.726	.081	.199	.390
Lyons Ferry	1	.3633	.2990	1.215	.2118	.2568	.825
	2	.3340	.3736	.894	.1853	.2578	.719
	3	<u>.2679</u>	<u>.2618</u>	<u>1.023</u>	<u>.1152</u>	<u>.1350</u>	<u>.853</u>
	Average	.322	.311	1.044	.171	.217	.799

however, by scrutinizing key components (i.e., test and control zone survival and project collection efficiency) incorporated in the survival estimation, it may be feasible to hypothesize which assumptions are not being met.

In the analysis to follow, an attempt was made to modify values of the key components in order to make the expected recovery proportions match the observed proportions of test and control fish at McNary and John Day simultaneously. A schematic of the key components involved from release to recovery site and formulas for computing expected recovery proportions at McNary and John Day are shown in Figure 30.

To simplify the approach, several additional assumptions and value assignments to key components were made. The average of the proportions and survival estimates from the three replicates (Table 25) is used, since relative changes between McNary and John Day-based survival estimates are fairly consistent across replicates. Initial values assigned to survival in the control zone to McNary and additional control zone to John Day are set to 0.8 (i.e., 20% mortality in each control zone). Since the passage index at McNary essentially adjusts the number of fish collected to the expected number collected as if no spill is occurring, the fish guidance efficiency (FGE) values of 83% for spring chinook and 76% for steelhead given in Kcrma, et.al.(1983) are used. Fish are then given the option of passing the project through the bypass system with a 2 percent mortality assigned or passing through the turbine units with a 10% mortality assigned (see formulas in Figure 30). The proportion using the bypass system that are not transported have an opportunity to continue their migration to John Day. The proportion removed for transportation was obtained by adding the number collected in the "B" tank through June 1 and number collected after June 1 in both tanks and dividing by total collected for the brand group of interest. An average of the three replicates is used for the transportation component.

FIGURE 30 Illustration of methodology used to derive expected proportions recovered at McNary and John Day dams based on various survival components from release to recovery site and collection efficiency at recovery site.



- S_o = Survival after initial mortalities related to hatchery condition
 S_T = Survival in test zone
 S_{c1} = Survival in control zone to McNary Dam
 S_{c2} = Survival in additional control zone to John Day Dam
 E_1 = Collection efficiency at McNary. Since passage index adjusts collection to a no spill condition, the FGE estimate used here.
 E_2 = Collection efficiency at Unit 3 John Day.
 T_1 = Proportion transported at McNary.

Formulas for expected proportions recovered

McNary--Test:

$$P_T (MCN) = S_o S_T S_{c1} E_1$$

McNary--Control:

$$P_c (MCN) = S_o S_{c1} E_1$$

John Day--Test:

$$P_T (JDA) = S_o S_T S_{c1} (E_1 (1-T_1)(.98) + (1-E_1)(.90)) S_{c2} E_2$$

John Day--Control:

$$P_c (JDA) = S_o S_{c1} (E_1 (1-T_1)(.98) + (1-E_1)(.90)) S_{c2} E_2$$

Theoretically, the initial survival component S_0 can be viewed as measuring the initial mortality hatchery fish experience when released. It applies a constant reduction to both test and control groups above what may be viewed as mortality occurring by migrating through a particular reach. In the analysis, this component is computed as the proportional reduction necessary to obtain expected recovery proportions close to the observed proportions at McNary given the estimated test zone and assumed control zone survival values and assumed collection efficiency (i.e., FGE value). Therefore, the interpretational value of S_0 is relative to the magnitude of the other survival estimates.

Theoretically, the component E_2 would be the collection efficiency at Unit 3 at John Day. However, this component encompasses more than FGE and spill efficiency since only one gatewell of a high fish passage unit is monitored. As was the case with the preceding component S_0 , the E_2 component is computed as the proportional reduction necessary to obtain expected recovery proportions close to the observed proportions at John Day. This proportion reduction is applied equally to test and control groups.

The results of the investigation indicate that the average survival estimate for the test reach may be too high for both the Wells and Lyons Ferry test releases based on McNary recovery proportions, but too low for the Wells test releases based on the John Day recovery proportions. The Lyons Ferry average survival estimate based on John Day recovery proportions may be fairly reasonable. The average survival estimate for the Winthrop test releases appears quite reasonable based on the McNary recovery proportions, and too low based on the John Day recovery proportions. How these conclusions were reached are discussed for each hatchery group in the following paragraphs.

'The average survival estimate in the test reach for Wells Hatchery steelhead was /3% based on McNary recoveries and 39% based on John Day recoveries (Table 26).

TABLE 26 Comparison of predicted test and control group proportions recovered at McNary and John Day dams given three survival estimates for mid-Columbia test zone for Wells Hatchery steelhead.

Group	Site	Survival Recovery per Project	S_T	S_o	S_{c1}	E_1	T_1	S_{c2}	E_2	Observed Proportion Recovered		Predicted Proportion Recovered	
										MCN	JDA	MCN	JDA
WeT	MCN	.94	.73	.44	.8	.76	.47	.8	.63	.195	.081	.195	.079
WeC	MCN	--	--	.44	.8	.76	.45	.8	.63	.264	.199	.268	.108
WeT	JDA	.83	.39	.82	.8	.76	.47	.8	.63	.195	.081	.194	.079
WeC	JDA	--	--	.82	.8	.76	.45	.8	.63	.264	.199	.499	.201
WeT	Neither	.86	.47	.69	.8	.76	.47	.8	.63	.195	.081	.197	.080
WeC	Neither	--	--	.69	.8	.48	.45	.8	.63	.264	.199	.265	.202

How the various key components are computed in this table as well as in the subsequent tables for the other study groups is as follows. The first two rows refer to McNary as the recovery site ("McNary-based estimate"). The component S_o is computed to make the predicted McNary test and control recovery proportion agree to the observed. The next two rows refer to John Day as the recovery site ("John-Day based estimate"). The component S_o is recomputed to balance the predicted and observed test proportions at McNary, and the predicted control proportion is simply computed using this S_o value. The component E_2 is computed to balance the predicted and observed test and control proportions at John Day. The value of E_2 is then applied to the test and control groups in the first two rows, The expected test and control proportions at John Day for a McNary-based estimate are now computed.

The outcome is that the observed proportion at John Day is higher than expected if the McNary-based values are "true", and the observed control proportion at McNary is lower than expected if the John Day-based values are "true". These conditions would imply that the collection efficiency at McNary is lower for control than test groups assuming survival in the control zones is the same between groups. The result would be that the McNary-based estimate was too high and the John-Day based estimate too low. If the McNary-based estimate is in fact "true" then one would have to assume over 50 percent of the test and control groups experience initial mortality soon after release. It would appear unlikely that S_o would be so low, and then survival per project be so high (94%).

The last two rows of the table give a hypothetical survival estimate for the test zone and a revised value for S_o between the original two estimates. This illustrates that reducing the collection efficiency on Wells control groups can provide expected recovery proportions comparable to the observed proportion at both recovery sites. The recomputed S_o appears more reasonable as a measure of initial mortality of hatchery fish after release and the 86% survival per project estimate,

which includes reservoir mortality, appears more reasonable. This exercise does not demonstrate that the test zone survival should be 0.47, but rather implies that the estimate based on McNary recoveries may be high due to violation of design assumptions.

The average survival estimate in the test reach for Lyons Ferry Hatchery steelhead was in excess of 100% based on McNary recoveries and 80% based on John Day recoveries (Table 27). The observed recovery proportion of control fish at McNary was lower than expected if the John Day-based estimate is "true". This would imply that the collection efficiency for the control group was lower than that of the test group, and the test survival estimate lower than actual. However, it is unlikely that survival per project is higher than that obtained by the John-Day based estimate. By assuming a reduced survival on the control group and lower collection efficiency operating simultaneously, it is possible to *get* agreement between control and test group recovery proportions *at* both sites and still maintain an estimate of test reach survival similar to that based on John Day recovery proportions.

What can be concluded from this example is that the unrealistic (greater than 100%) survival estimates based on McNary recovery proportions are due to violations of the design assumptions. Small changes in survival and collection efficiency can lead to more reasonable estimates.

The average survival estimate in the test reach for Winthrop Hatchery spring chinook was 0.47 based on McNary recovery proportions and 0.29 based on John Day recovery proportions (Table 28). The observed recovery proportion of test fish was lower than expected at John Day if the McNary-based estimate is "true". The observed recovery proportion of test fish was higher than expected at McNary if the John Day-based estimate is "true". No feasible adjustment can be made for the test group in the McNary control zone, S_{c1} , or collection efficiency value, E_1 , to

TABLE 27 Comparison of predicted test and control group proportions recovered at McNary and John Day dams given three survival estimates for the lower Snake River test zone for Lyons Ferry Hatchery steelhead.

Group	Recovery Site	Survival per Project	<u>S_T</u>	<u>S_o</u>	<u>S_{c1}</u>	<u>E₁</u>	<u>T₁</u>	<u>S_{c2}</u>	<u>E₂</u>	Observed Proportion Recovered		Predicted Proportion Recovered	
										<u>MCN</u>	<u>JDA</u>	<u>MCN</u>	<u>JDA</u>
LYT	MCN	1.00%	1.04	Not Applicable						.322	.171		
LyC	MCN									.311	.217		
LYT	JDA	.89	.80	.65	.8	.76	.41	.8	.77	.322	.171	.395	.168
LyC	JDA	--	--	.65	.8	.76	.37	.8	.77	.311	.217		.220
LYT	Neither	.88	.77	.69	.8	.76	.41	.8	.77	.322	.171	.323	.171
LyC	Neither	--	--	.69	.71	.63	.37	.8	.77	.311	.217	.309	.218

TABLE 28 Comparison of predicted test and control group proportions recovered at McNary and John Day dams given three survival estimates for the mid-Columbia test zone for Winthrop Hatchery spring chinook.

Group	Recovery Site	Survival per Project	S_T	S_o	S_{c1}	E_1	T_1	S_{c2}	E_2	Observed Proportion Recovered		Predicted Proportion Recovered	
										MCN	JDA	MCN	JDA
WIT	MCN	.86	.47	.78	.8	.83	.14	.8	.45	.239	.059	.243	.090
WiC	MCN	--	--	.78	.8	.83	.08	.8	.45	.515	.205	.518	.202
WIT	JDA	.78	.29	.78	.8	.83	.14	.8	.45	.239	.059	.150	.056
WiC	JDA	--	--	.78	.8	.83	.08	.8	.45	.515	.205	.518	.202
WiT	MCN	.86	.47	.78	.8	.83	.14	.8	.30	.239	.059	.243	.060
WiC	MCN	--	--	.78	.8	.83	.08	.8	.45	.515	.205	.518	.202

obtain agreement between observed and expected recovery proportions. Rather, only by reducing either the test group survival in John Day pool, S_{c2} , the collection efficiency values, E_2 , or both, can agreement be reached.

Although it is feasible that this reduction in proportion of test fish recovered at John Day can be a function of lower John Day pool survival or lower collection efficiency, only the reduction in component E_2 is shown in Table 28. The median date of passage for the Winthrop test groups was close to a period when both flow in John Day pool was low and spill was very high. Passage counts on May 25 - 27 were extremely low. On average, 4.6% of the test fish were recovered on those three days, whereas 22.1% were recovered on the following three days, May 28 - 30. Spill levels averaged 44% of the flow on May 25 and 26 with flows averaging 205 kcfs, whereas on May 27 flows increased to 285 kcfs, and for May 28 - 30 flows increased to 339 kcfs with spill levels averaging 19% over this four day interval. It is apparent the Winthrop test groups were more affected by this project operation than the control groups since the control group date of median passage was up to a week earlier at John Day. It is feasible that the migration slowed during the low flow days exposing more test fish to predation than control fish, or the spill efficiency in passing smolts at high spill levels may have been higher than that inherent in the passage index adjustment.

The conclusion of this example is that the McNary-based average estimate of test reach survival is more reasonable than that based on John Day recovery proportions. The 86% survival per project appears reasonable and close in magnitude to the hypothetical estimates generated for steelhead.

VI. HATCHERY RELEASES

The FPC worked closely with federal and state fishery agencies to ensure that hatchery fish received favorable migratory conditions after their release. The Water Budget managers make flow and operations management decisions based on arrival of fish at mainstem projects. Since most of these fish are from hatcheries, it was necessary to be aware of hatchery release dates and anticipate time of arrival of these fish at mainstem dams for the purpose of making operations requests. The FPC reported hatchery releases in a Weekly Report which was sent to all entities interested in the juvenile migration.

Annually, millions of juvenile hatchery-reared salmonids are released above Bonneville Dam to begin their migration to the ocean. About 66.3 million hatchery salmonids were released in 1986 (Table 29); this was about 2.4 million more than in 1983 and 1985, and about 8.8 million less than in 1984. Juvenile release totals in the Snake River have been increasing annually with additional lower Snake River compensation hatcheries on line. Both the mid and lower Columbia hatchery release totals for 1986 were about the same as 1985 and lower than 1983 and 1984. The "tule" stock fall chinook releases have decreased by about 7 million since 1983, mainly due to reduced adult returns and subsequent less egg/fry production.

The fish totals shown are those which were planted at hatcheries or hauled to streams generally from fish releases made from September 1, 1985 to August 31, 1986. We believed this time period gives the best picture of fish migrating in 1986. For example if sub-yearling spring chinook were released in September 1985, they would be included as a 1986 migrant unless the fish agency recommended that this release group be classified as 1985 outmigrants,

Not all fish which are released from hatcheries will migrate. **Thus.** the release totals only represent those which are actually accounted for at release time. The agency releasing the fish makes the final decision as to the migration year.

It should be noted that releases do not include fry outplants made in various streams in Idaho, Washington, and Oregon. Since there are no set estimates of fry/smolt survival for the Columbia Basin, release totals are not included for fry plants. About 945,000 spring/summer chinook fry and 3 million steelhead fry were outplanted in 1986 in Idaho, which illustrates that outplanted releases are substantial.

TABLE 29 SUMMARY OF FISH RELEASES BY SPECIES AND RELEASE AREA FROM 1983 TO 1986

River Area	Spring	Summer	Fall Chinook		Coho	Steelhead	Total
	Chinook	Chinook	Brights	Tule			
1986 ²							
Snake R.	5,513,135	982,443	2,271,520	0	0	7,586,945	16,354,043
Mid-Col. R.	4,437,238	1,992,057	10,385,476	0	554,563	1,494,630	18,863,964
Lower Col. R.	6,581,373	0	4,276,328	14,797,393	4,883,127	566,627	31,104,848
TOTAL	16,531,746	2,974,500	16,933,324	14,797,393	5,437,690	9,648,202	66,322,855
1985							
Snake R.	7,086,889	781,405	1,317,921	0	0	5,849,153	15,035,368
Mid-Col. R.	4,715,729	1,630,322	10,689,637	0	388,790	1,344,712	18,769,190
Lower Col. R.	6,344,905	0	5,298,276	15,505,925	2,162,846	738,290	30,050,242
TOTAL	18,147,523	2,411,727	17,305,834	15,505,925	2,551,636	7,932,155	63,854,800
1984							
Snake R.	8,054,425	356,673	427,191	0	0	6,214,760	15,053,049
Mid-Col. R.	6,129,744	1,240,865	15,548,324	0	517,100	1,422,329	24,858,362
Lower Col. R.	6,398,645	0	3,604,403	20,773,294	3,905,834	534,124	35,216,300
TOTAL	20,582,814	1,597,538	19,579,918	20,773,294	4,422,934	8,171,213	75,127,711
1983							
Snake R.	5,626,000	264,000	115,000	0	0	3,475,000	9,480,000
Mid-Col. R.	4,369,017	1,608,798	12,537,557	0	535,029	1,235,000	20,285,401
Lower Col. R.	4,743,230	0	2,370,249	21,200,000 ¹	5,385,004	447,000	34,145,483
TOTAL	14,738,247	1,872,798	15,022,806	21,200,000	5,920,033	5,157,000	63,910,884

¹ 1983 Tule Fall Chinook numbers are estimated.

² 1986 data is preliminary; includes revisions through 1/30/87.

Note: 210,000 sockeye were released 6/84 by IDFG in Stanley and Alturas Lake (Snake River area).

VII. CONCLUSIONS and RECOMMENDATIONS

- o The 1986 average January through July runoff was 21% above average in the Snake River, 8% below average in the mid-Columbia, and 1% above average in the lower Columbia. For comparisons of travel time and survival of salmonid marked groups in the 1984 - 1986 SMP studies, 1986 was an intermediate flow and spill year between the higher flow and spill year of 1984 and the lower flow and spill year of 1985.
- o Passage indices, which provide a relative measure of run magnitude, are comparable among years for a given species at a particular project. This comparison is accurate to the extent that collection efficiency remains relatively stable among years. Minor relative changes (i.e., less than 25%) in passage indices occurred between 1985 and 1986 for all species at Lower Granite and all species except coho at McNary. Much larger relative changes occurred between 1984 and 1985 for all species at these two projects. Large relative changes (i.e., 200% and above) in passage indices occurred between 1985 and 1986 for sub-yearling chinook and coho at Rock Island,

Recommendation: Future research should be directed at evaluating collection efficiency at key collection sites such as McNary, Lower Granite, and Rock Island.

- o Sampling occurred at: Lewiston trap from March 15 through May 29; Lower Granite from April 5 through July 24; Lower Monumental from March 25 through August 23; Rock Island from April 1 through August 31; McNary from March 26 through September 26; and John Day from March 28 through October 30.
- o At Lower Granite, yearling chinook appear to have been migrating slightly earlier each year since 1984, while steelhead have been consistent in migration dates over the three years. In the mid-Columbia, spring chinook migration timing began about one week later in 1986 than 1985; but the date of median passage was close both years. Steelhead migration dates at Rock Island were

consistent between 1985 and 1986, coho migration was about one week earlier in 1986 due to an earlier hatchery release, and the sub-yearling chinook date of median passage was a full month earlier due to the sustained high flow and spill during the first 10 days of June. McNary migration timing of yearling chinook, sub-yearling chinook, steelhead and sockeye was fairly consistent among the three years 1984-1986. Coho migrated past McNary about 2 weeks later in 1985 than in 1984 or 1986, apparently due to the later hatchery release date and lower flows in 1985. The migration timing at John Day in 1986 was very similar to McNary for steelhead, coho and sockeye, while the yearling and sub-yearling chinook date of median passage was 4 and 12 days later, respectively. Due to the high spring flows and associated high spill levels from the end of May through the first 10 days of June, exceptionally large collections of wild sub-yearling chinook fry were made earlier than usual at Rock Island, McNary and John Day in 1986.

- o A large number of brand groups, both hatchery and in-river marked smolts, were available to estimate travel time in various reaches of the basin this year. Results from branded fish marked for the Smolt Monitoring Program were augmented with travel time results from other hatchery evaluation and transportation research releases. In general, the following summarizes the travel time patterns expressed in terms of migration speed observed in 1986. Yearling chinook averaged approximately 11 miles per day in the lower Snake (from Lower Granite to McNary), 10.5 miles/day in the mid-Columbia (from Methow River to McNary) and 20 miles per day from McNary to John Day. Sub-yearling chinook groups ranged from about 3 to 6 miles/day when migrating through John Day pool. They appear to reside in John Day pool for up to one month before moving downstream. Sims, et.al. (1984) found that sub-yearling chinook were residing in John Day pool for about 22 days. This makes their migration speed greater than 3 miles per day. Steelhead averaged between 15 and 20 miles/day in the

lower Snake (between Lower Granite or Little Goose and McNary). In the mid-Columbia (between Methow River and McNary), steelhead traveled at a speed of approximately 15 miles/day. From McNary to John Day, steelhead appear to travel about 35 miles/day, but these may be overestimates based on the Section V discussion of reliability of John Day pool travel time estimates for steelhead.

- o Comparison of travel time from Lower Granite to McNary between freeze branded and PIT tagged Dworshak spring chinook and steelhead showed close agreement for steelhead and a one week difference for spring chinook. The dates of median passage at Lower Granite were within one day for all paired groups. Likewise, the dates of median passage at McNary were within one day apart for steelhead groups. However, the date of median passage at McNary was 6 days earlier for the spring chinook PIT tagged group than that for the freeze branded group. In all cases, PIT tagged groups were recovered in greater proportion at both sampling sites than were the freeze branded groups.

Recommendation: NMFS has a proposal to investigate at differences in recovery rates between freeze branded and PIT tagged smolts in the 1987 SMP. That study should address possible causes for the difference in timing of the recovery distributions of freeze branded and PIT tagged spring chinook at McNary.

- o Average travel time per project of the 1984-1986 SMP branded groups compared favorably with the travel time per project to flow relationship generated with data spanning the past 14 years between Lower Granite and John Day.
- o Survival estimates within the mid-Columbia from the Methow River to below Priest Rapids Dam were obtained for Winthrop Hatchery spring chinook and Wells Hatchery steelhead. Survival of Winthrop spring chinook averaged 46.8% and survival of Wells steelhead averaged 72.2%. This gives an average survival per project estimate of 86% for Winthrop spring chinook and 94% for Wells steelhead. An

- examination of the recovery proportions of Winthrop and Wells test and control groups at both McNary and John Day suggests that the Winthrop group survival estimate appears reasonable, but the Wells group survival estimate may be biased high due to potential design assumption violations (see Section V discussion).
- o For the second year, survival estimates in the lower Snake River from below Little Goose to below Ice Harbor Dam greater than 100% were obtained for Lyons Ferry steelhead. An examination of the recovery proportions of Lyons Ferry test and control groups at both McNary and John Day suggests that biased estimates may be due to assumption violations (see Section V discussion).

Recommendation: In conducting survival studies with test and control releases, examination of whether the assumptions are being violated is an important consideration. This is not an easy task since the researcher cannot directly test for assumption violations. In the 1987 SMP, investigation of the smoltification levels and stress of test and control groups at release, and at McNary upon recovery, is planned. This would provide indirect evidence of differences between paired test and control groups that could violate design assumptions. In addition, since achieving mixing at McNary is not possible for test and control groups released long distances apart, further research is needed into whether the assumptions inherent in the passage index adjustment are reasonable (e.g., spill efficiency equals 1.0). Assessment of whether collection efficiency is stable over time within the year and among years at McNary would be useful. Also the effect of smoltification level on collection efficiency needs to be researched. Different release strategies may need to be explored if excessive mortality is occurring at release site following a truck release. In conclusion, design assumptions need more thorough scrutiny in future years.

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APPENDIX I

1986 Columbia River Hatchery Releases

APPENDIX I: 1986 Columbia Basin Hatchery Releases

Hatchery Releases

Summaries of hatchery salmonids released into the Columbia River Basin above Bonneville Dam are presented in Tables A-1 and A-2. Table A-1 includes hatchery releases made between September 1, 1985 and August 30, 1986 that were classified as active migrants in 1986. Table A-2 includes releases made in 1986 that were classified as 1987 migrants.

Each report is organized in alphabetical order by agency and hatchery, respectively. Within each Agency/Hatchery section the individual releases are in ascending order by the start date of the release. The number of releases and total number of fish released is summarized by hatchery and agency. Table headings requiring clarification are defined below:

AGCY = The agency, tribe or private company responsible for the release, identified by an acronym.

BRD YR = Brood year; the year of egg production.

MGR YR = Migration year; the year that all or the majority of the fish release are expected to migrate.

RELEASE DATES = The start and end dates of the release period.

ZONE = Major river zone of the release site; LCOL = Lower Columbia River system; MCOL = Mid-Columbia River system; SNAK = Snake River system.

FPC LOT ID = An identification number assigned by the FPC to each hatchery release.

Brand Releases

The brand release table (Table A-3) summarizes freeze branded fish released above Bonneville Dam from September 1, 1985 through August 30, 1986. Branded fish released below Bonneville as part of the FPC/COE transport study are also included in this table. Table A-3 is organized similarly to the hatchery release tables (Tables A-1 and A-2). Each major release in the brand release table (identified by a unique lot ID) includes one or more groups of freeze

brand releases. Each freeze brand group within a major release has a unique combination of brand location, brand symbol, and brand rotation. The agency, hatchery and lot ID associated with a major release group can be used to reference additional information from the hatchery release tables. Major freeze brand releases listed in Table A-3 with the hatchery identified as "non-hatchery" (i.e., originating from captures of actively migrating fish) are not listed in Tables A-2 or A-3. Freeze branded fish released as part of the FPC Smolt Monitoring Program are identified with a "Y" under the "FPC Brand" heading. The number of freeze brand releases and total number of fish released are summarized by major release group (i.e., lot ID), hatchery, and agency. These totals are indicated by asterisks on the table margins.

APPENDIX TABLE

A-1

Hatchery Releases above Bonneville Dam
expected to migrate in 1986

PROGRAM WBC670
TIME 11.14.39

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Hatchery Releases *

PAGE NO. 1
DATE 1/30/87

* These data are preliminary and have been derived from various sources. For *
* verification and/or origin of data, contact the operators of the Fish Passage Data *
* System at (503) 230-4290. *

		BRO SIZE		MGR	RELEASE	NUMBER	RELEASE	RIVER	FPC	COMMENTS
		YR	SIZE	YR	DATE	RELEASED	SITE	NAME	LOT ID	
		YR	#/lb	YR				ZONE		
AGCY HATCHERY.....	SPECIES.....									
	/ STOCK									
IDFG MCCALL	SU CHINOOK	84	21	86	3/24/86	970,348	S F SALMON R	S F SALMON R	86018	317K CMT 10-30-(10,11,12)
	SALMON R.				3/31/86					50,785 CMT 10-28-(4 & 12), 43,487 FB.
*					HATCHERY TOTAL.	970,348	FROM	1 RELEASES		*
NIAGARA SPRING	STEELHEAD	85	25	86	11/03/85	330,520	HELLS CANYON	SNAKE R	86005	100% AD CLIP.
	"A"HELLS CANYON				11/15/85					
	STEELHEAD	85	5	86	3/24/86	614,038	PAHSIMEROI H	PAHSIMEROI R	86001	100% AD CLIP.
	"A" PAHSIMEROI				4/05/86					39K LV-CMT 10-28-(16 & 17).
	STEELHEAD	85	5	86	4/05/86	246,320	PANTHER CRK	SALMON R	86002	100% AD CLIP.
	"A" PAHSIMEROI				4/09/86					30,829 LV-CMT.
	STEELHEAD	85	5	86	4/15/86	819,495	HELLS CANYON	SNAKE R	86004	100% AD CLIP. 50K FB.
	"A"HELLS CANYON				5/02/86					41K LV-CMT 10-28-41.
*					HATCHERY TOTAL.	2,010,373	FROM	4 RELEASES		*
PAHSIMEROI H	SU CHINOOK	84	16	86	3/15/86	12,095	PAHSIMEROI R	PAHSIMEROI R	86006	VOLITIONAL RELEASE.
	UPPER SALMON R.				3/19/86					
	SP CHINOOK	84	16	86	3/15/86	80,948	PAHSIMEROI R	PAHSIMEROI R	86016	VOLITIONAL RELEASE.
	UPPER SALMON R.				3/19/86					
*					HATCHERY TOTAL.	93,043	FROM	2 RELEASES		*
RAPID RIVER H	SP CHINOOK	84	22	86	3/15/86	1,594,688	RAPID RIVER	RAPID R	86013	44,692 FB.
	RAPID RIVER				4/07/86					307K CMT 10-30-(13,14,15) FOR STOCK CONTRIBUTION.
	SP CHINOOK	84	20	86	3/26/86	140,000	HELLS CANYON	SNAKE R	86014	44,754 FB.
	RAPID RIVER				3/27/86					
*					HATCHERY TOTAL.	1,734,688	FROM	2 RELEASES		*
RED RIVER	SP CHINOOK	84	30	86	3/31/86	136,800	RED R	RED R	86015	PLANTED OCT. 85,
	RAPID RIVER				4/04/86					VOLITIONAL RELEASE (ACTUAL START DATE OF MIGRATION UNKNOWN,
										DATE ESTIMATED).
*					HATCHERY TOTAL.	136,800	FROM	1 RELEASES		*
SAWTOOTH H	SP CHINOOK	84	26	86	3/17/86	347,481	SAWTOOTH H	SALMON R	86017	80K CMT, 35,851 FB.
	UPPER SALMON R.				3/17/86					
	SP CHINOOK	84	28	86	3/18/86	108,690	E F SALMON R	E F SALMON R	86007	
	E.F. SALMON R.				3/19/86					
*					HATCHERY TOTAL.	456,171	FROM	2 RELEASES		*
**	AGENCY TOTAL...					5,401,423	FROM	12 RELEASES		**

PROGRAM WBC670
TIME 11.14.32

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Hatchery Releases *

PAGE NO. 2
DATE 1/30/87

* These data are preliminary and have been derived from various sources. For *
* verification and/or origin of data, contact the operators of the Fish Passage Data *
* System at (503) 230-4290. *

FROM 6/11/85 TO 12/31/86

AGCY HATCHERY.....	SPECIES..... / STOCK	BRD SIZE YR #/lb	MGR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....	
ODFW IRRIGON	FA CHINOOK BONNEVILLE URB	84	5	86	3/21/86 3/24/86	90,841	UMATILLA R	UMATILLA R	LCOL	86062	100% CMT. REL AT MINTHORN HOLDING POND, RM 60. VOLITIONAL RELEASE.
	FA CHINOOK BONNEVILLE URB	84	5	86	3/22/86 3/25/86	100,000	UMATILLA R	UMATILLA R	LCOL	86069	REL AT BONIFER HOLDING POND, RM 80. VOLITIONAL RELEASE.
	SU STEELHEAD IMNAHA	85	5	86	4/29/86 4/30/86	115,437	LI SHEEP CRK	IMNAHA R	SNAK	86067	100%AD, 26K FB 50% AD-LV-CMT 7-37-(60&61)
	SU STEELHEAD WALLOWA	85	5	86	4/29/86 5/05/86	194,553	WALLOWA H	WALLOWA R	SNAK	86068	100% AD, APPROX 40% AT 4/LB WITH 75% AD-LV-CMT 7-37-(62&63) & 29K FB APPROX 60% AT 5/LB WITH 50% AD-LV-CMT 7-38-(01&02) & 29K FB
	FA CHINOOK BONNEVILLE URB	85	86	86	6/09/86 6/11/86	2,029,258	UMATILLA R	UMATILLA R	LCOL	86063	210K AD-CMT 7-38-(33-42)
	SP CHINOOK CARSON	85	25	86	6/11/86 6/16/86	379,450	GRANDE RONDE R	GRANDE RONDE R	SNAK	86079	
	SP CHINOOK CARSON	85	23	86	6/18/86 6/18/86	92,680	HOOD R	HOOD R	LCOL	86078	
	FA CHINOOK BONNEVILLE URB	85	12	86	10/16/86 10/16/86	35,574	UMATILLA R	UMATILLA R	LCOL	86076	100% LV CLIP CMT. REL AT MINTHORN HOLDING POND, RM 60.
	SP CHINOOK CARSON	85	20	87	10/21/86 10/21/86	75,000	UMATILLA R	UMATILLA R	LCOL	86075	100% CMT. REL AT BONIFER HOLDING POND, RM 80.
					HATCHERY TOTAL.	3,112,793	FROM 9 RELEASES				
* LOOKINGGLASS H	SP CHINOOK CARSON	84	32	86	7/19/85 7/19/85	104,800	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86070	100% AD-CMT.
	SP CHINOOK CARSON	84	19	86	9/18/85 9/18/85	373,454	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86071	27% AD-CMT, 40,237 FB.
	SP CHINOOK CARSON	84	17	86	11/01/85 11/01/85	277,997	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86072	36.9% AD-CMT.
	SP CHINOOK CARSON	84	10	86	11/23/85 11/23/85	90,233	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86073	59% AD-CMT.
	SP CHINOOK IMNAHA	84	11	86	3/28/86 3/28/86	35,014	IMNAHA R	IMNAHA R	SNAK	86054	100% AD-CMT.

PROGRAM MBC670
TIME 11.14.32

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Hatchery Releases *

PAGE NO. 3
DATE 1/30/87

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* System at (503) 230-4290. *

FROM 6/11/85 TO 12/31/86

AGCY HATCHERY.....	SPECIES..... / STOCK	BRD SIZE YR #/lb	MGR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....	
ODFW LOOKINGGLASS H	SP CHINOOK LOOKINGGLASS	84	11	86	4/01/86 4/01/86	47,708	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86053	100% LV,89% AD-CMT.
	SP CHINOOK CARSON	84	11	86	4/01/86 4/01/86	100,070	BIG CANYON CRK	WALLOWA R	SNAK	86056	
	SP CHINOOK CARSON	84	12	86	4/01/86 4/04/86	315,557	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86057	49% AD-CMT, 40K FB
	SP CHINOOK CARSON	84	10	86	4/02/86 4/02/86	100,136	CATHERINE CRK	GRANDE RONDE R	SNAK	86058	
	SP CHINOOK CARSON	84	14	86	5/01/86 5/01/86	258,098	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86080	
	SP CHINOOK	85	54	87	7/17/86 7/17/86	88,543	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86083	100% CMT 7-39-(54 & 55).
	SP CHINOOK	85	52	87	7/29/86 7/29/86	37,760	CATHERINE CRK	GRANDE RONDE R	SNAK	86082	
	SP CHINOOK LOOKINGGLASS	85	24	87	9/24/86 9/24/86	163,275	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86084	26K CMT-AD 07-38-3,4, 40K FB
	SP CHINOOK LOOKINGGLASS	85	24	87	11/01/86 11/01/86	164,886	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86086	
*				HATCHERY TOTAL.	2,157,531	FROM	14	RELEASES			
OAK SPRINGS	SU STEELHEAD S. SANTIAM	85	4	86	4/07/86 4/11/86	82,816	HOOD R	HOOD R	LCOL	86065	100% AD CLIP.
	SU STEELHEAD UMATILLA	85	8	86	5/01/86 5/04/86	54,137	UMATILLA R	UMATILLA R	LCOL	86064	100% AD CLIP. REL AT BONIFER HOLDING POND, RM 80.
*				HATCHERY TOTAL.	136,953	FROM	2	RELEASES			
ROUND BUTTE H	SP CHINOOK DESCHUTES	84	6	86	3/12/86 3/13/86	62,946	DESCHUTES R	DESCHUTES R	LCOL	86052	100% AD-CMT.
	SU STEELHEAD DESCHUTES	85	5	86	4/07/86 4/14/86	171,459	DESCHUTES R	DESCHUTES R	LCOL	86066	100% AD CLIP, 33% LP-RH, 67% LP-LH.
	SP CHINOOK DESCHUTES	84	8	86	6/05/86 6/05/86	212,898	DESCHUTES R	DESCHUTES R	LCOL	86051	62,994 AD-CMT 07-33-21, 74,744 LV-LH, 75,160 LP. VOLITIONAL RELEASE.
*				HATCHERY TOTAL.	447,303	FROM	3	RELEASES			

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AGCY HATCHERY.....	SPECIES.....	BRD	SIZE	MGR	RELEASE	NUMBER	RELEASE SITE	RIVER	FPC	COMMENTS.....
	/ STOCK	YR	#/LB	YR	DATES	RELEASED		NAME	ZONE	LOT ID	
ODFW TROJAN POND	WI STEELHEAD	85	5	86	3/17/86 3/21/86	39,907	HOOD R	HOOD R	LCOL	86085	
*					HATCHERY TOTAL	39,907	FROM	1	RELEASES		*
**					AGENCY TOTAL...	5,874,487	FROM	29	RELEASES		**

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AGCY HATCHERY.....	SPECIES..... / STOCK	BRD YR	SIZE #/lb	MGR Y6	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....
USFW CARSON NFH	SP CHINOOK	84	25	86	3/06/86 3/06/86	443,000	WIND R	WIND R	LCOL	86129	
	SP CHINOOK CARSON	84	22	86	4/11/86 4/13/86	99,970	UMATILLA R	UMATILLA R	LCOL	86137	REL AT BONIFER HOLDING POND, RM 80
	SP CHINOOK	84	18	86	4/15/86 4/15/86	1,949,460	WIND R	WIND R	LCOL	86130	480K AD-CWT 5-16-(8 THRU 25).
	SP CHINOOK	85	33	87	11/26/86 11/26/86	180,000	CARSON NFH	WIND R	LCOL	86150	
HATCHERY TOTAL.						2,672,430	FROM 4 RELEASES				
DWORSHAK NFH	SP CHINOOK LEAVENWORTH	84	20	86	3/27/86 4/02/86	164,286	LGR FOREBAY	SNAKE R	SNAK	86120	100% FB. SPILL/BYPASS TEST.
	SP CHINOOK LEAVENWORTH	84	20	86	4/02/86 4/03/86	506,320	N F CLEARWATER	N F CLEARWATER	SNAK	86108	80K CWT 10-28-43, 10-25-20 40,675 FB.
	STEELHEAD "B" CLEARWATER	85	7	86	4/14/86 4/30/86	1,347,287	S F CLEARWATER	S F CLEARWATER	SNAK	86107	100% AD CLIP, 50K LV-CWT 05-17-29.
	STEELHEAD "B" CLEARWATER	85	8	86	4/16/86 5/13/86	1,240,236	DWORSHAK NFH	CLEARWATER R	SNAK	86104	100% AD CLIP, 51K FB, INCLUDING 16K TRUCKED TO ABOVE CLEARWATER TRAP, 75K LV-CWT 10-28-86, 05-17-(53 & 54).
	STEELHEAD "B" CLEARWATER	85	7	86	4/24/86 5/07/86	369,845	M F CLEARWATER	M F CLEARWATER	SNAK	86121	100% AD CLIP.
HATCHERY TOTAL.						3,627,974	FROM 5 RELEASES				
ENTIAT NFH	SP CHINOOK	84	19	86	4/22/86 4/22/86	835,000	ENTIAT R	ENTIAT R	MCOL	86124	
HATCHERY TOTAL.						835,000	FROM 1 RELEASES				
HAGERMAN NFH	STEELHEAD "A" HELLS CANYON	84	19	86	11/05/85 11/15/85	56,833	HELLS CANYON	SNAKE R	SNAK	86134	100% AD CLIP. SURVIVAL NOT 100%.
	STEELHEAD "A" SAWTOOTH	84	11	86	12/10/85 12/10/85	91,688	LITTLE SALMON R	SALMON R	SNAK	86135	100% AD CLIP. SURVIVAL NOT 100%.
	STEELHEAD "A" SAWTOOTH	84	11	86	1/07/86 1/09/86	125,587	LITTLE SALMON R	SALMON R	SNAK	86136	100% AD CLIP. SURVIVAL NOT 100%.

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AGCY HATCHERY.....	SPECIES.....	BRD SIZE	MGR	RELEASE	NUMBER	RELEASE SITE	RIVER	ZONE	FPC	COMMENTS.....	
	/ STOCK	YR #/lb	YR	DATES	RELEASED		NAME		LOT ID		
USFW HAGERMAN NFH	STEELHEAD	85	5	86	3/26/86	525,316	E F SALMON R	SNAK	86103	100% AD CLIP, 51,325 FB.	
	"B" SALMON R.				4/14/86					28,932 LV-CMT 10-28-20, REL 4/1-4/3.	
	STEELHEAD	85	5	86	3/27/86	699,715	SAWTOOTH H	SNAK	86101	100% AD CLIP, 52,300 FB.	
	"A" UPR SALMON				4/18/86					10,054 LV-CMT 10-28-01, REL 4/10.	
										41,389 LV-CMT 10-28-44, REL 4/10-4/11	
	STEELHEAD	85	4	86	4/17/86	302,303	HAZARD CREEK	LITTLE SALMON R	SNAK	86102	100% AD CLIP,
	"A"HELLS CANYON				4/30/86					47,814 LV-CMT 10-28-(05 & 42). REL 4/24.	
*					HATCHERY TOTAL.	1,801,442	FROM	6	RELEASES		
KOOKIA NFH	SP CHINOOK	84	16	86	3/26/86	351,405	CLEAR CRK	CLEARWATER R	SNAK	86109	
	CLEAR CREEK				3/27/86						
*					HATCHERY TOTAL.	351,405	FROM	1	RELEASES		
LEAVENWORTH NFH	SP CHINOOK	84	62	86	6/11/85	101,191	YAKIMA R	YAKIMA R	MCOL	86138	9K FB.
	LEAVENWORTH				6/11/85						REL BY YAKIMA TRIBE.
	SP CHINOOK	84	22	86	9/18/85	101,724	YAKIMA R	YAKIMA R	MCOL	86139	10K FB-AD-CMT 5-15-46.
	LEAVENWORTH				9/19/85						REL 150 MI FROM COLUMBIA RIVER.
	SP CHINOOK	84	22	86	10/29/85	52,798	LEAVENWORTH NFH	WENATCHEE R	MCOL	86143	26,800 FB-CMT 5-15-59.
					10/29/85						
	SP CHINOOK	84	20	86	11/19/85	95,431	YAKIMA R	YAKIMA R	MCOL	86140	10K FB-AD-CMT 5-15-47.
	LEAVENWORTH				11/20/85						
	SP CHINOOK	84	7	86	3/28/86	182,406	YAKIMA R	YAKIMA R	MCOL	86123	90% CMT 5-15-(48 THRU 51)
					4/28/86						23K FB.
	SP CHINOOK	84	17	86	4/23/86	1,970,000	LEAVENWORTH NFH	WENATCHEE R	MCOL	86122	40K FB.
					4/23/86						
	SU STEELHEAD	84	7	86	4/28/86	35,198	LEAVENWORTH NFH	WENATCHEE R	MCOL	86110	100% AD CLIP.
					4/28/86						REL AT ICICLE CREEK.
*					HATCHERY TOTAL.	2,538,748	FROM	7	RELEASES		
LWHITE SALMON H	COHO	84	20	86	3/06/86	1,208,535	LWHITE SALMON R	LWHITE SALMON R	LCOL	86105	
					3/06/86						
	FA CHINOOK	85	18	86	4/14/86	85,830	LWHITE SALMON R	LWHITE SALMON R	LCOL	86118	100% AD-CMT
	UPRIVER BRIGHTS				4/14/86						5-14-(41 THRU 44).

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AGCY HATCHERY.....	SPECIES.....	BRD SIZE	YR	NR	RELEASE	NUMBER	RELEASE SITE	RIVER	FPC	COMMENTS.....
	/ STOCK	YR	YR	YR	DATES	RELEASED		NAME	ZONE	LOT ID	
USFW LWHITE SALMON H SP	CHINOOK	84	11	86	4/14/86 4/14/86	412,212	LWHITE SALMON R	LWHITE SALMON R	LCOL	86131	52K AD-CWT 5-14-(39 & 40)
	SP CHINOOK LITTLE WHITE	85	67	86	5/14/86 5/14/86	903,736	WHITE SALMON R	WHITE SALMON R	LCOL	86133	
	SP CHINOOK CARSON	85	56	86	6/17/86 6/19/86	500,000	WHITE SALMON R	WHITE SALMON R	LCOL	86132	REL ABOUT 20M ABOVE NORTHWESTERN DAM.
	FA CHINOOK UPRIVER BRIGHTS	85	113	86	6/18/86 6/18/86	1,169,825	LWHITE SALMON R	LWHITE SALMON R	LCOL	86119	200K AD-CWT 5-18-(7 THRU 10), 979K-107/LB. 190K-165/LB.
	SP CHINOOK	85	54	86	6/20/86 6/20/86	628,354	LWHITE SALMON R	LWHITE SALMON R	LCOL	86147	
	COHO	85	27	87	10/01/86 10/01/86	1,200,000	LWHITE SALMON R	LWHITE SALMON R	LCOL	86149	
	HATCHERY TOTAL.					6,008,492	FROM	8 RELEASES			
SPRING CRK NFH	FA CHINOOK TULE	85	124	86	3/06/86 3/06/86	3,726,782	SPRING CRK NFH	LOWER COLUMBIA	LCOL	86111	200K AD-CWT 85-1-(9,12,13).
	FA CHINOOK TULE	85	69	86	4/08/86 4/08/86	3,691,170	SPRING CRK NFH	LOWER COLUMBIA	LCOL	86112	200K AD-CWT 85-1-(10,14,15).
	FA CHINOOK UPRIVER BRIGHTS	85	90	86	5/06/86 5/06/86	200,000	SOC SEC PONDS	LOWER COLUMBIA	LCOL	86114	100K AD-CWT 85-03-(12 THRU 15).
	FA CHINOOK TULE	85	38	86	5/15/86 5/15/86	3,176,941	SPRING CRK NFH	LOWER COLUMBIA	LCOL	86113	200K AD-CWT 85-1-11, 85-2-(8 & 9).
	FA CHINOOK UPRIVER BRIGHTS	85	90	86	5/15/86 5/15/86	210,000	ROCK CREEK	LOWER COLUMBIA	LCOL	86115	626K AD-CWT 85-2-(14 & 15), 85-3-(8 THRU 15), 85-4-(8 & 9).
	FA CHINOOK UPRIVER BRIGHTS	85	100	86	5/19/86 5/22/86	1,901,360	YAKIMA R	YAKIMA R	MCOL	86117	10K FB, 200K AD-CWT 5-17-(62 & 63), 5-18-(5 & 6).
	FA CHINOOK UPRIVER BRIGHTS	85	90	86	5/20/86 5/20/86	180,000	ROCK CREEK	LOWER COLUMBIA	LCOL	86145	
	FA CHINOOK UPRIVER BRIGHTS	85	100	86	5/22/86 5/23/86	472,848	HANFORD	MID COLUMBIA R	MCOL	86116	100K AD-CWT 5-17-(58 THRU 61).
	FA CHINOOK UPRIVER BRIGHTS	85	140	86	6/04/86 6/06/86	175,000	ROCK CREEK	LOWER COLUMBIA	LCOL	86146	CWT
	HATCHERY TOTAL.					13,634,101	FROM	9 RELEASES			

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AGCY HATCHERY.....	SPECIES..... / STOCK	BRD SIZE YR 1/16	MGR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME ZONE	FPC LOT ID	COMMENTS.....
USFW WILLARD NFH	COHO	84	17	86 4/18/86 4/18/86	100,000	WHITE SALMON R	WHITE SALMON R	LCOL	86141	
	COHO	84	15	86 5/14/86 5/14/86	2,457,168	WHITE SALMON R	WHITE SALMON R	LCOL	86106	
*		HATCHERY TOTAL.				2,557,168	FROM	2 RELEASES		*
WINTHROP NFH	SP CHINOOK WINTHROP	84	16	86 4/21/86 4/29/86	534,292	METHOW R	METHOW R	MCOL	86125	103K FB.
	SP CHINOOK WINTHROP	84	13	86 4/21/86 4/29/86	35,894	BELOW PRD DAM	MID COLUMBIA R	MCOL	86126	100% FB.
	SP CHINOOK LEAVENWORTH	84	18	86 4/21/86 4/21/86	528,502	METHOW R	METHOW R	MCOL	86144	
*		HATCHERY TOTAL.				1,098,688	FROM	3 RELEASES		*
WARM SPRINGS H.	SP CHINOOK	84	10	86 10/01/85 10/01/85	325,823	WARM SPRINGS R	WARM SPRINGS R	LCOL	86127	
	SP CHINOOK	84	18	86 4/09/86 4/09/86	420,394	WARM SPRINGS R	WARM SPRINGS R	LCOL	86128	300K RV-LV.
	SP CHINOOK	85	9	87 10/01/86 10/01/86	160,188	WARM SPRINGS R	WARM SPRINGS R	LCOL	86148	79K LV CLIP 81K RV CLIP
*		HATCHERY TOTAL.				906,405	FROM	3 RELEASES		*
**		AGENCY TOTAL...				36,031,853	FROM	49 RELEASES		**

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AGCY HATCHERY.....	SPECIES..... / STOCK	BRD YR	SIZE #/lb	MGR YR	RELEASE DATE	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....
WDF KICKITAT H	COND MIXED	84	20	86	4/01/86 6/09/86	1,117,424	KICKITAT R	KICKITAT R	LCOL	86153	26K CMT 63-35-13, 26K CMT 63-35-14; 4/1-14 220,930 REL AT 16.9/LB; 4/15-28 329,376 REL AT 16.2/LB; 4/29-5/12 395,115 REL AT 14.1/LB; 5/13-5/26 154,194 REL AT 13.1/LB; 5/27-6/9 17,809 REL AT 13.1/LB.
	FA CHINOOK BIG CREEK	85	98	86	4/02/86 4/02/86	1,000,000	KICKITAT R	KICKITAT R	LCOL	86165	
	FA CHINOOK BIG CREEK	85	72	86	4/18/86 4/18/86	1,426,600	KICKITAT R	KICKITAT R	LCOL	86166	
	FA CHINOOK BIG CREEK	85	54	86	5/01/86 5/01/86	1,417,000	KICKITAT R	KICKITAT R	LCOL	86152	
	SP CHINOOK KICKITAT	84	8	86	5/02/86 5/06/86	629,900	KICKITAT R	KICKITAT R	LCOL	86151	
	FA CHINOOK LITTLE WHITE	85	55	86	6/02/86 6/02/86	358,900	KICKITAT R	KICKITAT R	LCOL	86167	
	HATCHERY TOTAL.					5,949,824	FROM 6 RELEASES				
LYONS FERRY	FA CHINOOK	84	10	86	4/02/86 4/03/86	481,950	LYONS FERRY	SNAKE R	SNAP	86154	40K FB.
	FA CHINOOK	85	70	86	6/10/86 6/10/86	1,542,168	LYONS FERRY	SNAKE R	SNAP	86155	80K FB. 249K AD-CMT 63-36-(38 THRU 42).
	FA CHINOOK	85	55	86	6/13/86 6/13/86	247,402	BELOW IHR DAM	SNAKE R	SNAP	86168	100% AD-CMT 63-36-(33 THRU 37). BARGED FROM HATCHERY TO RELEASE SITE.
	HATCHERY TOTAL.					2,271,520	FROM 3 RELEASES				
PRIEST RAPIDS H	FA CHINOOK PRIEST RAPIDS	84	8	86	4/01/86 4/01/86	196,000	PRIEST RAPIDS H	MID COLUMBIA R	MCOL	86164	YEARLING CHINOOK. 50% AD-CMT 63-23-30.
	FA CHINOOK PRIEST RAPIDS	85	70	86	6/05/86 6/25/86	6,363,000	PRIEST RAPIDS H	MID COLUMBIA R	MCOL	86156	205K AD-CMT 63-R4-41-2 6/5 1.47M W/103K CMT REL., 6/10 1.3M W/100K FB REL., 6/12 1.485M W/102K CMT REL., 6/19 1.19M W/100K FB REL., 6/25 925K REL.
	HATCHERY TOTAL.					6,559,000	FROM 2 RELEASES				
RINGOLD H	FA CHINOOK PRIEST RAPIDS	84	6	86	4/01/86 4/06/86	1,300,000	RINGOLD H	MID COLUMBIA R	MCOL	86157	50K FB.
	HATCHERY TOTAL.					1,300,000	FROM 1 RELEASES				

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AGCY HATCHERY.....	SPECIES..... / STOCK	BRD SIZE YR #/lb	WGR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....
WDF ROCKY REACH H	FA CHINOOK PRIEST RAPIDS	84 11	86	5/05/86 5/05/86	252,268	ROCKY REACH H	MID COLUMBIA R	MCOL	86158	200K CWT
	COND	84 17	86	5/05/86 5/05/86	554,563	ROCKY REACH H	MID COLUMBIA R	MCOL	86159	
*				HATCHERY TOTAL.	806,831	FROM	2 RELEASES			*
WELLS H	SU CHINOOK	84 12	86	4/22/86 4/30/86	200,440	WELLS H	MID COLUMBIA R	MCOL	86160	
	SU CHINOOK	85 60	86	5/29/86 6/02/86	1,644,967	WELLS H	MID COLUMBIA R	MCOL	86162	100K FB, 200K CWT 63-34-(60 THRU 63).
	SU CHINOOK	85 40	86	7/30/86 7/30/86	146,650	WELLS H	MID COLUMBIA R	MCOL	86163	50K AD-CWT 01-07-07.
*				HATCHERY TOTAL.	1,992,057	FROM	3 RELEASES			*
**				AGENCY TOTAL...	18,879,232	FROM	17 RELEASES			**

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AGCY HATCHERY.....	SPECIES..... / STOCK	BRD SIZE YR #/lb	MGR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....	
WDG CHELAN PUD	SU STEELHEAD WELLS	85	5	86	4/08/86 4/16/86	133,370	WENATCHEE R	WENATCHEE R	NCOL	86205	100% AD CLIP.
	SU STEELHEAD WELLS	85	5	86	4/15/86 4/15/86	46,185	ENTIAT R	ENTIAT R	NCOL	86204	100% AD CLIP.
				HATCHERY TOTAL.	179,555	FROM	2	RELEASES			
* LYONS FERRY	SU STEELHEAD WELLS	85	6	86	4/21/86 5/01/86	155,605	TOUCHET R	TOUCHET R	NCOL	86213	100% AD CLIP.
	SU STEELHEAD WELLS	85	6	86	4/21/86 5/01/86	138,845	WALLA WALLA R	WALLA WALLA R	NCOL	86214	100% AD CLIP.
	SU STEELHEAD WELLS	85	6	86	4/21/86 4/29/86	60,167	BELOW LGS DAM	SNAKE R	SNAP	86215	FPC GROUP. 100% FB-AD CLIP.
	SU STEELHEAD WELLS	85	6	86	4/21/86 4/29/86	36,050	BELOW IHR DAM	SNAKE R	SNAP	86216	FPC GROUP. 100% FB-AD CLIP.
	SU STEELHEAD WELLS	85	6	86	4/21/86 5/01/86	25,830	WALLA WALLA R	WALLA WALLA R	NCOL	86218	100% AD CLIP. REL AT MILL CREEK.
	SU STEELHEAD WELLS	85	6	86	4/21/86 5/02/86	44,650	ASOTIN CREEK	SNAKE R	SNAP	86219	100% AD CLIP.
	SU STEELHEAD WALLOWA	85	5	86	4/22/86 5/02/86	124,077	GRANDE RONDE R	GRANDE RONDE R	SNAP	86210	100% AD CLIP. 60K FB-LV-CMT. REL AT COTTONWOOD CRK, RM 28.7. VOLITIONAL RELEASE
	SU STEELHEAD WELLS/WALLOWA	85	6	86	4/22/86 5/02/86	101,760	LYONS FERRY	SNAKE R	SNAP	86220	100% AD-LV-CMT-FB 5 MARK GROUPS OF 20K. VOLITIONAL RELEASE
	SU STEELHEAD WALLOWA	85	6	86	4/26/86 5/13/86	40,494	TUCANNON R	TUCANNON R	SNAP	86211	100% AD-FB-LV-CMT. REL AT CURL LAKE, RM 40. VOLITIONAL RELEASE
	SU STEELHEAD WELLS	85	6	86	4/26/86 5/13/86	100,574	TUCANNON R	TUCANNON R	SNAP	86212	100% AD CLIP. 40K FB-LV-CMT. REL AT CURL LAKE, RM 40. VOLITIONAL RELEASE
				HATCHERY TOTAL.	828,052	FROM	10	RELEASES			

PROGRAM WPC670
TIME 11:14:39

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Hatchery Releases *

PAGE NO. 12
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FROM 6/11/85 TO 12/31/86

AGCY HATCHERY.....	SPECIES..... / STOCK	BRO YR	SIZE #/lb	MOR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....
WBG NACHES H	SU STEELHEAD RINGOLD	85	6	86	4/01/86 4/12/86	108,630	YAKIMA R	YAKIMA R	MCOL	86208	100% AD CLIP. VOLITIONAL RELEASE AT NELSON SPRINGS.
*					HATCHERY TOTAL.	108,630	FROM 1	RELEASES			*
RINGOLD H	SU STEELHEAD RINGOLD	85	5	86	4/30/86 5/07/86	192,081	RINGOLD H	MID COLUMBIA R	MCOL	86207	100% AD CLIP. VOLITIONAL RELEASE
*					HATCHERY TOTAL.	192,081	FROM 1	RELEASES			*
SKAMANIA H	SU STEELHEAD SKAMANIA	85	6	86	4/15/86 5/07/86	80,021	KLICKITAT R	KLICKITAT R	LCOL	86222	100% AD CLIP.
	WI STEELHEAD SKAMANIA	85	6	86	4/23/86 4/25/86	35,433	WHITE SALMON R	WHITE SALMON R	LCOL	86224	100% AD CLIP.
	SU STEELHEAD SKAMANIA	85	6	86	4/23/86 5/01/86	19,836	WHITE SALMON R	WHITE SALMON R	LCOL	86233	100% AD CLIP.
*					HATCHERY TOTAL.	135,290	FROM 3	RELEASES			*
TURTLE ROCK H	SU STEELHEAD RINGOLD	85	9	86	5/09/86 5/09/86	183,045	ABOVE RRH DAM	MID COLUMBIA R	MCOL	86206	100% AD CLIP.
*					HATCHERY TOTAL.	183,045	FROM 1	RELEASES			*
VANCOUVER H	SU STEELHEAD SKAMANIA	85	6	86	4/18/86 4/28/86	55,068	KLICKITAT R	KLICKITAT R	LCOL	86225	100% AD CLIP.
	SU STEELHEAD VANCOUVER	85	6	86	4/23/86 4/28/86	27,950	WIND R	WIND R	LCOL	86230	100% AD CLIP
*					HATCHERY TOTAL.	83,018	FROM 2	RELEASES			*
WELLS HATCHERY	SU STEELHEAD WELLS	85	7	86	4/29/86 5/16/86	298,312	METHOW R	METHOW R	MCOL	86202	100% AD CLIP.
	SU STEELHEAD WELLS	85	7	86	4/30/86 5/08/86	50,984	OKANOGAN R	OKANOGAN R	MCOL	86201	100% AD CLIP. ALSO RELEASED INTO SIMILKAMEEN R.
	SU STEELHEAD WELLS	85	7	86	5/01/86 5/09/86	89,489	METHOW R	METHOW R	MCOL	86203	FPC GROUP. 100% AD-FB. RM 8
	SU STEELHEAD WELLS	85	7	86	5/01/86 5/09/86	35,298	BELOW FRD DAM	MID COLUMBIA R	MCOL	86226	FPC GROUP. 100% AD-FB.

PROGRAM WBC670
TIME 11.14.39

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Hatchery Releases *

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FROM 6/11/85 TO 12/31/86											
AGCY HATCHERY.....	SPECIES.....	BRD SIZE	MGR	RELEASE	NUMBER	RELEASE SITE	RIVER	FPC	COMMENTS.....	
/ STOCK	YR #/lb	YR	DATES	RELEASED		NAME	ZONE	LOT ID			
WDG WELLS HATCHERY	SU STEELHEAD	85	7	86	5/05/86 5/15/86	1,758	METHOW R	METHOW R	MCOL	86234	100% AD-UPPER CAUDAL CLIP PART OF FPC SURVIVAL STUDY HELD TO DETERMINE BRAND QUALITY AND LENGTH. BRAND 7P AND 7N WITH CAUDAL AD CLIP RECORDED AS P7 AND N7.
* HATCHERY TOTAL.					475,841	FROM	5	RELEASES	*		
** AGENCY TOTAL...					2,185,512	FROM	25	RELEASES	**		
*** TOTAL RELEASE..					68,392,507	FROM	132	RELEASES	***		

* L A S T P A G E *

APPENDIX TABLE

A-2

Hatchery Releases above Bonneville Dam
expected to migrate in 1987.

PROGRAM WBC670
TIME 11:15:12

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Hatchery Releases *

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FROM 1/01/86 TO 12/31/86

AGCY HATCHERY.....	SPECIES..... / STOCK	BRD YR #/lb	SIZE YR	MGR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....
ODFW IRRIGON	SP CHINOOK CARSON	85	20	87	10/21/86 10/21/86	75,000	UMATILLA R	UMATILLA R	LCOL	86075	100% CMT. REL AT BONIFER HOLDING POND, RM 80.
*					HATCHERY TOTAL.	75,000	FROM	1 RELEASES			*
LOOKINGGLASS H	SP CHINOOK	85	54	87	7/17/86 7/17/86	88,543	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86083	100% CMT 7-39-(54 & 55).
	SP CHINOOK	85	52	87	7/29/86 7/29/86	37,760	CATHERINE CRK	GRANDE RONDE R	SNAK	86082	
	SP CHINOOK LOOKINGGLASS	85	24	87	9/24/86 9/24/86	163,275	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86084	26K CMT-AD 07-38-3,4, 40K FB
	SP CHINOOK LOOKINGGLASS	85	24	87	11/01/86 11/01/86	164,886	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	86086	
					HATCHERY TOTAL.	454,464	FROM	4 RELEASES			*
					AGENCY TOTAL...	522,464	FROM	5 RELEASES			**

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PROGRAM WBC670
TIME 11:15:12

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Hatchery Releases *

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FROM 1/01/86 TO 12/31/86

AGCY HATCHERY.....	SPECIES.....	BRD YR	SIZE #/lb	MGR YR	RELEASE DATES	NUMBER RELEASED	RELEASE SITE	RIVER NAME	ZONE	FPC LOT ID	COMMENTS.....
USFW CARSON NFH	SP CHINOOK	85	33	87	11/26/86 11/26/86	180,000	CARSON NFH	WIND R	LCOL	86150	
*					HATCHERY TOTAL.	180,000	FROM	1	RELEASES		*
LWHITE SALMON H	COHO	85	27	87	10/01/86 10/01/86	1,200,000	LWHITE SALMON R	LWHITE SALMON R	LCOL	86149	
*					HATCHERY TOTAL.	1,200,000	FROM	1	RELEASES		*
WARM SPRINGS H	SP CHINOOK	85	9	87	10/01/86 10/01/86	160,188	WARM SPRINGS R	WARM SPRINGS R	LCOL	86148	79K LV CLIP 81K RV CLIP
*					HATCHERY TOTAL.	160,188	FROM	1	RELEASES		*
**					AGENCY TOTAL...	1,540,188	FROM	3	RELEASES		**
****					TOTAL RELEASE..	2,069,652	FROM	8	RELEASES		****

* L A S T P A G E *

APPENDIX TABLE

A-3

Brands released above Bonneville Dam

1986

PROGRAM WBC680
TIME 11:44:02

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
Brand Releases

FROM 9/01/85 TO 12/31/86

PAGE NO. 1
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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME	ZONE	COMMENTS.....	FPC BRAND
BATT NON-HATCHERY	FA CHINOOK	5/08/86	6/03/86	12,050	86304	01	RA	BB	1	5/08/86	5/14/86	1,500	YAKIMA R	YAKIMA R	MCOL NO CLIP, 500 REL 5/8, 1000 REL 5/14.	
						02	LA	BB	1	5/14/86	5/14/86	1,150	YAKIMA R	YAKIMA R	MCOL NO CLIP, RELEASED BEHIND IRRIGATION SCREENS.	
						04	LA	2L	1	5/14/86	5/14/86	1,000	YAKIMA R	YAKIMA R	MCOL NO CLIP, RELEASED BEHIND IRRIGATION SCREENS.	
						06	LA	2X	1	5/14/86	5/14/86	1,000	YAKIMA R	YAKIMA R	MCOL NO CLIP, RELEASED BEHIND IRRIGATION SCREENS.	
						03	RA	2L	1	5/14/86	5/14/86	1,150	YAKIMA R	YAKIMA R	MCOL NO CLIP.	
						05	RA	2X	1	5/14/86	5/14/86	1,150	YAKIMA R	YAKIMA R	MCOL NO CLIP.	
						10	LA	2L	3	6/03/86	6/03/86	1,000	YAKIMA R	YAKIMA R	MCOL NO CLIPS, RELEASED BEHIND IRRIGATION SCREENS.	
						11	LA	2X	3	6/03/86	6/03/86	1,000	YAKIMA R	YAKIMA R	MCOL NO CLIPS, RELEASE BEHIND IRRIGATION SCREENS.	
						12	LD	BB	1	6/03/86	6/03/86	450	YAKIMA R	YAKIMA R	MCOL NO CLIPS, RELEASED BEHIND IRRIGATION SCREENS.	
						07	RA	2L	3	6/03/86	6/03/86	1,000	YAKIMA R	YAKIMA R	MCOL NO CLIPS.	
						08	RA	2X	3	6/03/86	6/03/86	1,000	YAKIMA R	YAKIMA R	MCOL NO CLIPS.	
						09	RD	BB	1	6/03/86	6/03/86	650	YAKIMA R	YAKIMA R	MCOL NO CLIPS.	
												LOT ID TOTAL.	12,050	FROM 12	RELEASES	
	SP CHINOOK	5/12/86	5/21/86	2,525	86307	01	LA	BB	1	5/12/86	5/21/86	1,275	YAKIMA R	YAKIMA R	MCOL NO CLIP, 650 REL 5/12, 300 REL 5/14, 325 REL 5/21	
						02	RA	BB	1	5/13/86	5/21/86	625	YAKIMA R	YAKIMA R	MCOL NO CLIP, 300 REL 5/13, 325 REL 5/21	
						03	RD	BB	1	5/13/86	5/21/86	625	YAKIMA R	YAKIMA R	MCOL NO CLIP, 300 REL 5/13, 325 REL 5/21	
												LOT ID TOTAL.	2,525	FROM 3	RELEASES	
	STEELHEAD	5/13/86	6/12/86	4,820	86310	03	LD	BB	1	5/13/86	5/23/86	600	YAKIMA R	YAKIMA R	MCOL AD CLIP, 300 REL 5/13, 300 REL 5/23	
						01	RA	BB	1	5/13/86	5/23/86	600	YAKIMA R	YAKIMA R	MCOL AD CLIP, 300 REL 5/13, 300 REL 5/23	
						02	RD	BB	1	5/13/86	5/23/86	600	YAKIMA R	YAKIMA R	MCOL AD CLIP, 300 REL 5/13, 300 REL 5/23	
						04	LA	BB	1	5/23/86	5/23/86	620	YAKIMA R	YAKIMA R	MCOL AD CLIP	
						05	LA	2X	1	6/02/86	6/02/86	600	YAKIMA R	YAKIMA R	MCOL AD CLIP.	
						07	RA	2X	1	6/02/86	6/02/86	600	YAKIMA R	YAKIMA R	MCOL AD CLIP.	
						08	RD	2X	1	6/02/86	6/02/86	600	YAKIMA R	YAKIMA R	MCOL AD CLIP.	
						06	LD	2X	1	6/12/86	6/12/86	600	YAKIMA R	YAKIMA R	MCOL AD CLIP.	
												LOT ID TOTAL.	4,820	FROM 8	RELEASES	
												HATCHERY TOTAL.	19,395	FROM 23	RELEASES	
												AGENCY TOTAL	19,395	FROM 23	RELEASES	

PROGRAM WBC680
TIME 11.44.02

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
Brand Releases

FROM 9/01/85 TO 12/31/86

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND
IDFG MCCALL	SU CHINOOK	3/24/86	3/31/86	970,348	86018 01	RD	Y	3	3/24/86	3/31/86	43,487	S F SALMON R	S F SALMON R	SNAK		Y
									LOT ID TOTAL.		43,487	FROM 1	RELEASES			*
									HATCHERY TOTAL.		43,487	FROM 1	RELEASES			**
NIAGARA SPRING	STEELHEAD	4/15/86	5/02/86	819,495	86004 01	RD	T	2	4/25/86	4/29/86	51,328	HELLS CANYON	SNAK R	SNAK	AD-LV CLIP.	Y
									LOT ID TOTAL.		51,328	FROM 1	RELEASES			*
									HATCHERY TOTAL.		51,328	FROM 1	RELEASES			**
NON-HATCHERY	CHINOOK	4/02/86	5/27/86	16,738	86008 01	RD	K	1	4/02/86	4/03/86	2,793	BELOW LEW TRAP	SNAK R	SNAK		
					02	RD	K	2	4/05/86	4/07/86	1,596	BELOW LEW TRAP	SNAK R	SNAK		
					03	RD	K	3	4/10/86	4/13/86	2,743	BELOW LEW TRAP	SNAK R	SNAK		
					04	RD	K	4	4/15/86	4/17/86	1,392	BELOW LEW TRAP	SNAK R	SNAK		
					05	RA	K	1	4/22/86	5/05/86	4,100	BELOW LEW TRAP	SNAK R	SNAK		
					06	RA	K	2	4/26/86	4/28/86	2,421	BELOW LEW TRAP	SNAK R	SNAK		
					07	RA	K	3	5/06/86	5/14/86	1,227	BELOW LEW TRAP	SNAK R	SNAK		
					08	RA	K	4	5/15/86	5/19/86	45	BELOW LEW TRAP	SNAK R	SNAK		
					09	LD	K	1	5/24/86	5/27/86	421	BELOW LEW TRAP	SNAK R	SNAK		
									LOT ID TOTAL.		16,738	FROM 9	RELEASES			*
	STEELHEAD	4/02/86	5/27/86	2,788	86009 01	RD	K	1	4/02/86	4/03/86	17	BELOW LEW TRAP	SNAK R	SNAK		
					05	RA	K	1	4/22/86	5/05/86	1,154	BELOW LEW TRAP	SNAK R	SNAK		
					06	RA	K	2	4/26/86	4/28/86	314	BELOW LEW TRAP	SNAK R	SNAK		
					07	RA	K	3	5/06/86	5/14/86	867	BELOW LEW TRAP	SNAK R	SNAK		
					08	RA	K	4	5/15/86	5/19/86	101	BELOW LEW TRAP	SNAK R	SNAK		
					09	LD	K	1	5/24/86	5/27/86	335	BELOW LEW TRAP	SNAK R	SNAK		
									LOT ID TOTAL.		2,788	FROM 6	RELEASES			*
									HATCHERY TOTAL.		19,526	FROM 15	RELEASES			**
RAPID RIVER H	SP CHINOOK	3/15/86	4/07/86	1,594,688	86013 01	LD	Y	1	4/04/86	4/07/86	44,692	RAPID RIVER	RAPID R	SNAK		Y
									LOT ID TOTAL.		44,692	FROM 1	RELEASES			*
	SP CHINOOK	3/26/86	3/27/86	140,000	86014 01	LD	Y	3	3/26/86	3/27/86	44,754	HELLS CANYON	SNAK R	SNAK		Y
									LOT ID TOTAL.		44,754	FROM 1	RELEASES			*
									HATCHERY TOTAL.		89,446	FROM 2	RELEASES			**
SAWTOOTH H	SP CHINOOK	3/17/86	3/17/86	347,481	86017 01	RD	Y	1	3/17/86	3/17/86	35,851	SAWTOOTH H	SALMON R	SNAK		Y
									LOT ID TOTAL.		35,851	FROM 1	RELEASES			*
									HATCHERY TOTAL.		35,851	FROM 1	RELEASES			**
***									AGENCY TOTAL		232,638	FROM 20	RELEASES			***

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PROGRAM WBC680
TIME 11.44.02

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND	
NMFS NON-HATCHERY	SP CHINOOK	4/03/86	6/03/86	45,004	86256	01	RA	L	1	4/10/86	4/12/86	5,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
					02	RA	L	2	4/12/86	4/16/86	5,001	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
					03	RA	L	3	4/16/86	4/16/86	5,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
					04	RA	L	4	4/18/86	4/20/86	5,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
					05	RA	V	1	4/20/86	4/22/86	5,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
					06	RA	V	2	4/24/86	4/28/86	5,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
					07	RA	V	3	4/28/86	5/02/86	5,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
					08	RA	V	4	5/05/86	5/14/86	5,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
					09	RA	P	1	5/14/86	6/03/86	5,003	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.		
									LOT ID TOTAL.		45,004	FROM 9	RELEASES				
	SP CHINOOK	4/09/86	5/30/86	45,035	86255	01	LA	P	1	4/09/86	4/11/86	5,000	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
					02	LA	P	2	4/11/86	4/15/86	5,000	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
					03	LA	P	3	4/15/86	4/17/86	5,104	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
					04	LA	P	4	4/17/86	4/21/86	5,000	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
					05	LA	W	1	4/21/86	4/23/86	5,000	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
					06	LA	W	2	4/23/86	4/27/86	5,000	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
					07	LA	W	3	4/29/86	5/03/86	5,000	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
					08	LA	W	4	5/03/86	5/15/86	4,998	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
					09	LA	L	1	5/15/86	5/30/86	4,933	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.		
									LOT ID TOTAL.		45,035	FROM 9	RELEASES				
	CHINOOK	4/16/86	6/06/86	75,000	86251	01	RA	RF	1	4/23/86	5/03/86	9,832	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY. CWT 23-17-60.	
					05	RA	RN	1	4/24/86	5/02/86	10,479	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY. CWT 23-18-27.		
					02	RA	RF	2	5/05/86	5/11/86	12,458	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY. CWT 23-17-61.		
					06	RA	RN	2	5/05/86	5/08/86	8,831	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY. CWT 23-18-28.		
					03	RA	RF	3	5/12/86	5/18/86	6,961	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY. CWT 23-17-62.		
					07	RA	RN	3	5/12/86	5/16/86	4,782	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY. CWT 23-18-29.		
					08	RA	RN	4	5/19/86	5/23/86	1,457	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY. CWT 23-18-30.		

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
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# System at (503) 230-4290. #####
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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND
MWFS NON-HATCHERY	CHINOOK	4/16/86	6/06/86	75,000	86251 04	RA	RF	4	5/20/86	5/24/86	3,887	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY, CWT 23-17-63.	
					09	RA	RY	1	5/27/86	5/29/86	1,510	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY, CWT 23-18-01.	
					11	RA	RY	3	5/27/86	6/02/86	1,327	BELOW BON DAM	LOWER COLUMBIA	LCOL	PUD TRANSPORT STUDY, CWT 23-18-31.	
									LOT ID TOTAL.		61,524	FROM 10 RELEASES				
	CHINOOK	4/16/86	6/06/86	75,000	86252 01	LA	RH	1	4/23/86	5/03/86	9,464	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-02.	
					05	LA	RR	1	4/24/86	5/02/86	10,438	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-39.	
					02	LA	RH	2	5/05/86	5/11/86	12,473	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-03.	
					06	LA	RR	2	5/05/86	5/08/86	8,898	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-40.	
					03	LA	RH	3	5/12/86	5/18/86	7,890	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-04.	
					07	LA	RR	3	5/12/86	5/16/86	5,250	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-41.	
					08	LA	RR	4	5/19/86	5/23/86	1,521	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-42.	
					04	LA	RH	4	5/20/86	5/25/86	5,113	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-05.	
					09	LA	R7	1	5/27/86	5/29/86	665	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-06.	
					11	LA	R7	3	5/27/86	6/02/86	1,176	BELOW PRD DAM	MID COLUMBIA R	MCOL	PUD TRANSPORT STDY,CONTRL GROUP. CWT 23-18-43.	
									LOT ID TOTAL.		62,878	FROM 10 RELEASES				
	SP CHINOOK	4/21/86	5/31/86	55,000	86259 06	LA	I5	3	4/23/86	5/05/86	5,620	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
					07	LA	IV	3	5/06/86	5/07/86	5,054	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
					08	LA	ID	3	5/07/86	5/09/86	5,168	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
					09	LA	IM	3	5/09/86	5/11/86	5,239	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
					10	LA	IF	3	5/11/86	5/12/86	5,329	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
					03	LA	ID	1	5/17/86	5/20/86	5,111	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
					04	LA	IM	1	5/20/86	5/24/86	5,079	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
									LOT ID TOTAL.		36,600	FROM 7 RELEASES				

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TIME 11.44.02

NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
Brand Releases

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND	
NMFS NON-HATCHERY	SP CHINOOK	4/21/86	5/31/86	55,000	86260	01	RA	IU	1	4/24/86	5/08/86	5,235	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, TRANSPORT GROUP.	
						07	RA	IC	3	5/08/86	5/10/86	4,936	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, TRANSPORT GROUP.	
						03	RA	IF	1	5/10/86	5/11/86	5,209	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, TRANSPORT GROUP.	
						04	RA	ID	1	5/11/86	5/13/86	5,014	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, TRANSPORT GROUP.	
						05	RA	IM	1	5/13/86	5/14/86	5,119	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, TRANSPORT GROUP.	
						08	RA	IF	3	5/19/86	5/22/86	5,099	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, TRANSPORT GROUP.	
						09	RA	ID	3	5/22/86	5/26/86	5,032	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, TRANSPORT GROUP.	
										LOT ID TOTAL.	35,644	FROM 7 RELEASES					
	SP CHINOOK	5/01/86	5/30/86	14,476	86266	01	LA	IS	1	5/01/86	5/01/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						02	LD	IS	1	5/01/86	5/01/86	1,004	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						03	LA	IS	3	5/04/86	5/04/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						04	LD	IS	3	5/04/86	5/04/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						05	LA	IS	2	5/07/86	5/07/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						06	LD	IS	2	5/07/86	5/07/86	1,009	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						07	RD	IS	2	5/07/86	5/07/86	571	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						09	LA	IS	4	5/10/86	5/10/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						10	LD	IS	4	5/10/86	5/10/86	600	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						08	RA	IS	4	5/10/86	5/10/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						13	LD	IS	3	5/13/86	5/13/86	600	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						11	RA	IS	1	5/13/86	5/13/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						12	RD	IS	1	5/13/86	5/13/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						14	LA	IS	1	5/30/86	5/30/86	1,012	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						16	LD	IS	1	5/30/86	5/30/86	600	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						15	RA	IS	1	5/30/86	5/30/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
										LOT ID TOTAL.	14,476	FROM 16 RELEASES					
	CHINOOK	5/13/86	5/17/86	5,000	86263	01	RA	PP	1	5/13/86	5/13/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						02	RA	PP	2	5/14/86	5/14/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						03	LA	PP	1	5/15/86	5/15/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						04	LA	PP	2	5/16/86	5/16/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						05	RD	PP	1	5/17/86	5/17/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
										LOT ID TOTAL.	5,000	FROM 5 RELEASES					
	FA CHINOOK	6/11/86	8/20/86	160,000	86261	07	LA	17	3	6/11/86	6/18/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, CONTROL GROUP.	
						08	LA	3X	3	6/18/86	6/21/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP, CONTROL GROUP.	

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND	
NMFS NON-HATCHERY	FA CHINOOK	6/11/86	8/20/86	160,000	86261	09	LA	3J	3	6/21/86	6/27/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						11	LA	3C	3	6/27/86	7/08/86	10,810	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						12	LA	3L	3	7/09/86	7/15/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						13	LA	7H	3	7/15/86	7/19/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						14	LA	10	3	7/19/86	7/21/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						15	LA	7H	1	7/21/86	7/22/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						16	LA	10	1	7/22/86	7/23/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						01	LA	17	1	7/23/86	7/28/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						02	LA	3X	1	7/29/86	8/01/86	10,000	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						06	LA	3L	1	8/01/86	8/06/86	5,826	BELOW MCN DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. CONTROL GROUP.	
						LOT ID TOTAL.						116,636	FROM 12 RELEASES				
	FA CHINOOK	6/11/86	8/20/86	160,000	86262	01	RA	17	1	6/11/86	6/18/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						02	RA	3X	1	6/18/86	6/21/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						03	RA	3J	1	6/21/86	6/27/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						05	RA	3C	1	6/27/86	7/08/86	10,780	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						06	RA	3L	1	7/09/86	7/15/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						13	RA	7H	1	7/15/86	7/19/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						14	RA	10	1	7/19/86	7/21/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						15	RA	7H	3	7/21/86	7/22/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						16	RA	10	3	7/22/86	7/23/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						07	RA	17	3	7/23/86	7/30/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						09	RA	3J	3	7/30/86	8/01/86	4,357	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						11	RA	3C	3	8/01/86	8/06/86	10,000	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT-AD CLIP. TRANSPORT GROUP.	
						LOT ID TOTAL.						115,137	FROM 12 RELEASES				
	CHINOOK	7/01/86	7/12/86	5,000	86265	01	RA	PP	1	7/08/86	7/08/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						02	RA	PP	2	7/09/86	7/09/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						03	LA	PP	1	7/10/86	7/10/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						04	LA	PP	2	7/11/86	7/11/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						05	RD	PP	1	7/12/86	7/12/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						LOT ID TOTAL.						5,000	FROM 5 RELEASES				

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NATIONAL MARINE FISHERIES SERVICE
FISH PASSAGE DATA SYSTEM
* Brand Releases *

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND	
NMFS NON-HATCHERY	FA CHINOOK	7/17/86	7/31/86	12,000	86270	02	LA	IS	2	7/17/86	7/17/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						01	RA	IS	2	7/17/86	7/17/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						03	RD	IS	2	7/17/86	7/17/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						06	LA	IS	3	7/20/86	7/20/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						04	LD	IS	3	7/20/86	7/20/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						05	RD	IS	3	7/20/86	7/20/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						08	LA	IS	4	7/23/86	7/23/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						09	LD	IS	4	7/23/86	7/23/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						07	RA	IS	4	7/23/86	7/23/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						10	LD	IS	2	7/31/86	7/31/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						11	RD	IS	1	7/31/86	7/31/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						12	RD	IS	4	7/31/86	7/31/86	1,000	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						LOT ID TOTAL.					12,000	FROM 12 RELEASES					
	SUCKEYE	4/23/86	6/02/86	64,384	86253	01	RA	RF	1	4/23/86	4/26/86	8,624	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-17-31.	
						05	RA	RN	1	4/24/86	4/25/86	2,006	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-18-21.	
						02	RA	RF	2	4/27/86	5/03/86	4,664	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-17-32.	
						08	RA	RN	4	4/28/86	5/02/86	2,018	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-18-22.	
						03	RA	RF	3	5/05/86	5/11/86	5,037	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-17-33.	
						07	RA	RN	3	5/05/86	5/08/86	853	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-18-23.	
						09	RA	T	1	5/12/86	5/18/86	9,637	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-17-34.	
						13	RA	U	1	5/12/86	5/16/86	2,205	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-18-24.	
						14	RA	U	2	5/19/86	5/23/86	4,180	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-18-25.	
						10	RA	T	2	5/20/86	5/22/86	11,038	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-17-35.	
						11	RA	T	3	5/23/86	5/27/86	10,270	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-17-36.	
						15	RA	U	3	5/27/86	6/02/86	3,159	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-18-26.	
						12	RA	T	4	5/28/86	5/29/86	693	BELOW BON DAM	LOWER COLUMBIA	LCOL	CWT 23-18-62.	
						LOT ID TOTAL.					64,384	FROM 13 RELEASES					
	SUCKEYE	4/23/86	6/02/86	64,926	86254	01	LA	RH	1	4/23/86	4/26/86	8,711	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-17-37.	
						05	LA	RR	1	4/24/86	4/25/86	2,239	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-33.	
						02	LA	RH	2	4/27/86	5/03/86	4,932	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-17-38.	
						08	LA	RR	4	4/28/86	5/02/86	1,919	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-34.	
						03	LA	RH	3	5/05/86	5/11/86	4,313	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-17-39.	
						07	LA	RR	3	5/05/86	5/08/86	779	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-35.	
						13	LA	L	1	5/12/86	5/16/86	2,189	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-36.	
						09	LA	V	1	5/12/86	5/18/86	10,186	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-18.	
						14	LA	L	2	5/19/86	5/23/86	4,065	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-37.	
						10	LA	V	2	5/20/86	5/22/86	10,671	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-19.	
						11	LA	V	3	5/23/86	5/27/86	9,415	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-20.	
						15	LA	L	3	5/27/86	6/02/86	3,093	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-18-38.	
						12	LA	V	4	5/28/86	5/29/86	2,414	BELOW PRD DAM	MID COLUMBIA R	MCOL	CWT 23-19-01.	
						LOT ID TOTAL.					64,926	FROM 13 RELEASES					

NATIONAL MARINE FISHERIES SERVICE
 FISH PASSAGE DATA SYSTEM
 Br and Releases

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND	
NMFS NON-HATCHERY	STEELHEAD	4/15/86	5/27/86	33,168	86257	01	LA	P	1	4/15/86	4/27/86	4,319	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						02	LA	P	2	4/29/86	5/01/86	4,176	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						03	LA	P	3	5/01/86	5/08/86	4,966	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						04	LA	P	4	5/08/86	5/13/86	4,150	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						05	LA	W	1	5/13/86	5/17/86	4,249	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						06	LA	W	2	5/17/86	5/22/86	4,250	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						07	LA	W	3	5/22/86	5/27/86	4,250	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						08	LA	W	4	5/27/86	5/27/86	1,287	BELOW LGS DAM	SNAKE R	SNAK	LGR TRANSPORT CONTROL GROUP.	
						LOT ID TOTAL.						31,647	FROM 8 RELEASES				
	STEELHEAD	4/16/86	6/03/86	30,659	86258	01	RA	L	1	4/16/86	4/28/86	4,904	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
						02	RA	L	2	4/28/86	4/30/86	4,250	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
						03	RA	L	3	5/02/86	5/09/86	4,287	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
						04	RA	L	4	5/09/86	5/14/86	4,250	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
						05	RA	V	1	5/14/86	5/19/86	4,244	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
						06	RA	V	2	5/19/86	5/23/86	4,514	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
						07	RA	V	3	5/23/86	6/03/86	4,250	BELOW BON DAM	LOWER COLUMBIA	LCOL	LGR TRANSPORT TEST GROUP.	
						LOT ID TOTAL.						30,659	FROM 7 RELEASES				
	STEELHEAD	5/16/86	5/22/86	5,165	86267	02	LA	IS	1	5/16/86	5/16/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						03	LD	IS	1	5/16/86	5/16/86	600	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						01	RA	IS	1	5/16/86	5/16/86	1,022	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						04	LA	IS	2	5/22/86	5/22/86	1,010	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						05	RA	IS	2	5/22/86	5/22/86	923	JDA BYPASS	LOWER COLUMBIA	LCOL	UC CLIP.	
						06	RD	IS	2	5/22/86	5/22/86	600	JDA BYPASS	LOWER COLUMBIA	LCOL	LC CLIP.	
						LOT ID TOTAL.						5,165	FROM 6 RELEASES				
	STEELHEAD	5/20/86	5/24/86	5,000	86264	01	RA	PP	1	5/20/86	5/20/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						02	RA	PP	2	5/21/86	5/21/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						03	LA	PP	1	5/22/86	5/22/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						04	LA	PP	2	5/23/86	5/23/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						05	RD	PP	1	5/24/86	5/24/86	1,000	ABOVE MCN DAM	MID COLUMBIA R	MCOL	UC CLIP.	
						LOT ID TOTAL.						5,000	FROM 5 RELEASES				
	HATCHERY TOTAL.											756,715	FROM 166 RELEASES				
	AGENCY TOTAL...											756,715	FROM 166 RELEASES				

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NATIONAL MARINE FISHERIES SERVICE
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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME	ZONE	COMMENTS.....	FPC BRAND	
ODFW IRRIGON	SU STEELHEAD	4/29/86	4/30/86	115,437	86067	01	RA	J	2	4/29/86	4/30/86	13,217	LI SHEEP CRK	IMNAHA R	SNAK	100% AD, 50% AD-LV-CMT	
					02		RA	J	4	4/29/86	4/30/86	13,240	LI SHEEP CRK	IMNAHA R	SNAK	100% AD, 50% AD-LV-CMT	
										LOT ID TOTAL.	26,457	FROM	2	RELEASES		*	
	SU STEELHEAD	4/29/86	5/05/86	194,553	86068	03	LA	J	1	4/29/86	5/05/86	14,987	WALLOWA H	WALLOWA R	SNAK	100% AD, 50% AD-LV-CMT	
					04		LA	J	3	4/29/86	5/05/86	14,998	WALLOWA H	WALLOWA R	SNAK	100% AD, 50% AD-LV-CMT	
					01		RA	J	1	4/29/86	5/05/86	14,871	WALLOWA H	WALLOWA R	SNAK	100% AD, 75% AD-LV-CMT	
					02		RA	J	3	4/29/86	5/05/86	14,878	WALLOWA H	WALLOWA R	SNAK	100% AD, 75% AD-LV-CMT	
										LOT ID TOTAL.	59,734	FROM	4	RELEASES		*	
										HATCHERY TOTAL.	86,191	FROM	6	RELEASES		**	
LOOKINGGLASS H	SP CHINOOK	9/18/85	9/18/85	373,454	86071	01	RA	J	1	9/18/85	9/18/85	20,108	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	18/LB	
					02		RA	J	3	9/18/85	9/18/85	20,129	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	20/LB	
										LOT ID TOTAL.	40,237	FROM	2	RELEASES		*	
	SP CHINOOK	4/01/86	4/04/86	315,557	86057	01	RA	J	2	4/02/86	4/02/86	19,955	LOOKINGGLASS CR	GRANDE RONDE R	SNAK		
					02		RA	J	4	4/02/86	4/02/86	19,982	LOOKINGGLASS CR	GRANDE RONDE R	SNAK		
										LOT ID TOTAL.	39,937	FROM	2	RELEASES		*	
	SP CHINOOK	9/24/86	9/24/86	163,275	86084	01	LA	J	1	9/24/86	9/24/86	20,436	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	13K AD-CMT 07-28-04	
					02		LA	J	3	9/24/86	9/24/86	20,523	LOOKINGGLASS CR	GRANDE RONDE R	SNAK	13K AD-CMT 07-28-03	
										LOT ID TOTAL.	40,959	FROM	2	RELEASES		*	
										HATCHERY TOTAL.	121,133	FROM	6	RELEASES		**	
***										AGENCY TOTAL...	207,324	FROM	12	RELEASES		***	

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND	
UGFW DMORSHAK NFH	SP CHINOOK	3/27/86	4/02/86	164,286	86120	04	RA	A	1	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						05	RA	A	2	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						06	RA	A	3	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						07	RA	F	1	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						08	RA	F	2	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						09	RA	F	3	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						01	RA	PI	1	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						02	RA	PI	2	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						03	RA	PI	3	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						10	RA	R	1	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						11	RA	R	2	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						12	RA	R	3	3/27/86	3/27/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						16	LA	A	1	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						17	LA	A	2	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						18	LA	A	3	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						19	LA	F	1	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						20	LA	F	2	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						21	LA	F	3	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						13	LA	PI	1	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						14	LA	PI	2	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						15	LA	PI	3	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						22	LA	R	1	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						23	LA	R	2	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						24	LA	R	3	3/30/86	3/30/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						28	RD	A	1	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						29	RD	A	2	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						30	RD	A	3	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	GATEMELL RELEASE.	
						31	RD	F	1	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						32	RD	F	2	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						33	RD	F	3	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	CONTROL RELEASE.	
						25	RD	PI	1	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						26	RD	PI	2	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						27	RD	PI	3	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	TURBINE RELEASE.	
						34	RD	R	1	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						35	RD	R	2	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						36	RD	R	3	4/02/86	4/02/86	4,500	LGR FOREBAY	SNAKE R	SNAK	SPILL RELEASE.	
						LOT ID TOTAL.						162,000	FROM 36 RELEASES				*
	SP CHINOOK	4/02/86	4/03/86	506,320	86108	01	RA	Y	2	4/02/86	4/03/86	40,675	N F. CLEARWATER	N F. CLEARWATER	SNAK		Y
						LOT ID TOTAL.						40,675	FROM 1 RELEASES				*
	STEELHEAD	4/16/86	5/13/86	1,240,236	86104	01	RD	4	1	4/16/86	4/16/86	4,140	DMORSHAK NFH	CLEARWATER R	SNAK	AD CLIP.	
						02	RD	4	3	5/01/86	5/01/86	4,199	DMORSHAK NFH	CLEARWATER R	SNAK	AD CLIP.	
						05	RD	T	4	5/07/86	5/07/86	35,025	DMORSHAK NFH	CLEARWATER R	SNAK	AD CLIP.	
						03	LD	4	1	5/08/86	5/08/86	4,260	DMORSHAK NFH	CLEARWATER R	SNAK	AD CLIP.	

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND
USFW DMORSHAK NFH	STEELHEAD	4/16/86	5/13/86	1,240,236	86104 04	LD	4	3	5/13/86	5/13/86	4,247	DMORSHAK NFH	CLEARWATER R	SNAK	AD CLIP.	
*									LOT ID TOTAL.		51,871	FROM 5 RELEASES				*
**									HATCHERY TOTAL.		254,546	FROM 42 RELEASES				**
HAGERMAN NFH	STEELHEAD	3/26/86	4/14/86	525,316	86103 01	LD	T	4	4/07/86	4/09/86	51,325	E F SALMON R	E F SALMON R	SNAK	AD CLIP.	Y
*									LOT ID TOTAL.		51,325	FROM 1 RELEASES				*
	STEELHEAD	3/27/86	4/18/86	699,715	86101 01	LD	T	2	4/08/86	4/10/86	52,300	SANTOOTH H	SALMON R	SNAK	AD CLIP.	Y
*									LOT ID TOTAL.		52,300	FROM 1 RELEASES				*
**									HATCHERY TOTAL.		103,625	FROM 2 RELEASES				**
LEAVENWORTH NFH	SP CHINOOK	9/18/85	9/19/85	101,724	86139 01	LA	S	1	9/19/85	9/19/85	10,489	YAKIMA R	YAKIMA R	MCOL	AD-CMT.	
*									LOT ID TOTAL.		10,489	FROM 1 RELEASES				*
	SP CHINOOK	10/29/85	10/29/85	52,798	86143 01 02	LA RA	Z Z	1 1	10/29/85 10/29/85	10/29/85 10/29/85	13,751 13,050	LEAVENWORTH NFH LEAVENWORTH NFH	MEWATCHEE R MEWATCHEE R	MCOL MCOL		
*									LOT ID TOTAL.		26,801	FROM 2 RELEASES				*
	SP CHINOOK	11/19/85	11/20/85	95,431	86140 01	RA	S	2	11/19/85	11/20/85	10,000	YAKIMA R	YAKIMA R	MCOL	AD-CMT.	
*									LOT ID TOTAL.		10,000	FROM 1 RELEASES				*
	SP CHINOOK	3/28/86	4/28/86	182,406	86123 02	LA	3	1	3/28/86	3/28/86	5,910	YAKIMA R	YAKIMA R	MCOL	AD-CMT.	
					03	LA	3	4	3/28/86	3/28/86	5,438	YAKIMA R	YAKIMA R	MCOL	AD-CMT.	
					04	RA	3	4	3/28/86	3/28/86	5,255	YAKIMA R	YAKIMA R	MCOL	AD-CMT.	
					01	RA	3	1	4/09/86	4/28/86	6,383	YAKIMA R	YAKIMA R	MCOL	AD-CMT.	
*									LOT ID TOTAL.		22,986	FROM 4 RELEASES				*
	SP CHINOOK	4/23/86	4/23/86	1,970,000	86122 01	LA	7T	1	4/23/86	4/23/86	40,602	LEAVENWORTH NFH	MEWATCHEE R	MCOL	NO CLIPS.	Y
*									LOT ID TOTAL.		40,602	FROM 1 RELEASES				*
**									HATCHERY TOTAL.		110,878	FROM 9 RELEASES				**
SPRING CRK NFH	FA CHINOOK	5/19/86	5/22/86	1,801,360	86117 01	LD	S	1	5/19/86	5/22/86	10,094	YAKIMA R	YAKIMA R	MCOL	100% CMT	
*									LOT ID TOTAL.		10,094	FROM 1 RELEASES				*
**									HATCHERY TOTAL.		10,094	FROM 1 RELEASES				**

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME	ZONE	COMMENTS.....	FPC BRAND
USFW WINTHROP NFH	SP CHINOOK	4/21/86	4/29/86	534,292	86125 01	RA	7C	1	4/21/86	4/21/86	34,466	METHOW R	METHOW R	MCOL	NO CLIPS. ALSO PART OF LOT 86144.	Y
					02	RA	7C	3	4/25/86	4/25/86	34,485	METHOW R	METHOW R	MCOL	NO CLIPS.	Y
					03	RA	7T	3	4/29/86	4/29/86	34,353	METHOW R	METHOW R	MCOL	NO CLIPS.	Y
									LOT ID TOTAL.		103,304	FROM 3 RELEASES				*
	SP CHINOOK	4/21/86	4/29/86	35,894	86126 01	LA	7C	3	4/21/86	4/21/86	12,001	BELOW PRD DAM	MID COLUMBIA R	MCOL	NO CLIPS.	Y
					02	LA	7C	1	4/25/86	4/25/86	11,989	BELOW PRD DAM	MID COLUMBIA R	MCOL	NO CLIPS.	Y
					03	LA	7U	1	4/29/86	4/29/86	11,904	BELOW PRD DAM	MID COLUMBIA R	MCOL	NO CLIPS.	Y
									LOT ID TOTAL.		35,894	FROM 3 RELEASES				*
									HATCHERY TOTAL.		139,198	FROM 6 RELEASES				**
									AGENCY TOTAL...		618,341	FROM 60 RELEASES				***

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AGCY	HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND
WDF	LYONS FERRY	FA CHINOOK	4/02/86	4/03/86	481,950	86154 01	RA	7K	1	4/02/86	4/03/86	40,168	LYONS FERRY	SNAKE R	SNAK	NO CLIPS.	Y
*										LOT ID TOTAL.		40,168	FROM 1 RELEASES				*
		FA CHINOOK	6/10/86	6/10/86	1,542,168	86155 01	RA	T	3	6/10/86	6/10/86	81,003	LYONS FERRY	SNAKE R	SNAK	NO CLIPS.	Y
*										LOT ID TOTAL.		81,003	FROM 1 RELEASES				*
**										HATCHERY TOTAL.		121,171	FROM 2 RELEASES				**
	PRIEST RAPIDS H	FA CHINOOK	6/05/86	6/25/86	6,363,000	86156 01	LA	T	1	6/10/86	6/10/86	100,276	PRIEST RAPIDS H	MID COLUMBIA R	MCOL	NO CLIPS.	Y
						02	LA	T	4	6/19/86	6/19/86	100,374	PRIEST RAPIDS H	MID COLUMBIA R	MCOL	NO CLIPS.	Y
*										LOT ID TOTAL.		200,650	FROM 2 RELEASES				*
**										HATCHERY TOTAL.		200,650	FROM 2 RELEASES				**
	RINGOLD H	FA CHINOOK	4/01/86	4/06/86	1,300,000	86157 01	RA	7U	3	4/01/86	4/06/86	50,000	RINGOLD H	MID COLUMBIA R	MCOL	NO CLIPS.	Y
*										LOT ID TOTAL.		50,000	FROM 1 RELEASES				*
**										HATCHERY TOTAL.		50,000	FROM 1 RELEASES				**
	WELLS H	SU CHINOOK	5/29/86	6/02/86	1,644,967	86162 01	RD	S	1	5/29/86	5/29/86	100,447	WELLS H	MID COLUMBIA R	MCOL	NO CLIPS.	Y
*										LOT ID TOTAL.		100,447	FROM 1 RELEASES				*
**										HATCHERY TOTAL.		100,447	FROM 1 RELEASES				**
***										AGENCY TOTAL...		472,268	FROM 6 RELEASES				***

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND
WDG LYONS FERRY	SU STEELHEAD	4/21/86	4/29/86	60,167	86215	01	RA	7F	1	4/21/86	4/29/86	20,035	BELOW LGS DAM	SNAKE R	SNAK AD CLIP.	Y
						02	RA	7F	3	4/25/86	4/25/86	20,063	BELOW LGS DAM	SNAKE R	SNAK AD CLIP.	Y
						03	RD	7F	1	4/29/86	4/29/86	20,069	BELOW LGS DAM	SNAKE R	SNAK AD CLIP.	Y
										LOT ID TOTAL.	60,167	FROM 3 RELEASES				*
	SU STEELHEAD	4/21/86	4/29/86	36,050	86216	01	LA	7U	1	4/21/86	4/29/86	11,998	BELOW IHR DAM	SNAKE R	SNAK AD CLIP.	Y
						02	LA	7U	3	4/25/86	4/25/86	12,034	BELOW IHR DAM	SNAKE R	SNAK AD CLIP.	Y
						03	LD	7U	1	4/29/86	4/29/86	12,018	BELOW IHR DAM	SNAKE R	SNAK AD CLIP.	Y
										LOT ID TOTAL.	36,050	FROM 3 RELEASES				*
	SU STEELHEAD	4/22/86	5/02/86	124,077	86210	01	RA	IJ	1	4/22/86	5/02/86	20,000	GRANDE RONDE R	GRANDE RONDE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE	
						03	RA	IJ	3	4/22/86	5/02/86	20,000	GRANDE RONDE R	GRANDE RONDE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE	
						02	RA	IJ	4	4/22/86	5/02/86	20,000	GRANDE RONDE R	GRANDE RONDE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE	
										LOT ID TOTAL.	60,000	FROM 3 RELEASES				*
	SU STEELHEAD	4/22/86	5/02/86	101,760	86220	03	LA	IJ	1	4/22/86	5/02/86	20,000	LYONS FERRY	SNAKE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
						05	LA	IJ	3	4/22/86	5/02/86	20,000	LYONS FERRY	SNAKE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
						04	LA	IJ	4	4/22/86	5/02/86	20,000	LYONS FERRY	SNAKE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
						01	LA	IK	1	4/22/86	5/02/86	20,000	LYONS FERRY	SNAKE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
						02	LA	IK	3	4/22/86	5/02/86	20,000	LYONS FERRY	SNAKE R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
										LOT ID TOTAL.	100,000	FROM 5 RELEASES				*
	SU STEELHEAD	4/26/86	5/13/86	40,494	86211	01	LA	IT	1	4/26/86	5/13/86	20,000	TUCANNON R	TUCANNON R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
						02	LA	IT	3	4/26/86	5/13/86	20,000	TUCANNON R	TUCANNON R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
										LOT ID TOTAL.	40,000	FROM 2 RELEASES				*
	SU STEELHEAD	4/26/86	5/13/86	100,574	86212	01	RA	IK	1	4/29/86	5/13/86	20,000	TUCANNON R	TUCANNON R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
						02	RA	IK	3	4/29/86	5/13/86	20,000	TUCANNON R	TUCANNON R	SNAK AD-LV-CWT. VOLITIONAL RELEASE.	
										LOT ID TOTAL.	40,000	FROM 2 RELEASES				*
**										HATCHERY TOTAL.	336,217	FROM 18 RELEASES				**

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AGCY	HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME	ZONE	COMMENTS.....	FPC BRAND	
WDC	WELLS HATCHERY	SU STEELHEAD	5/01/86	5/09/86	89,489	86203	01	LA	7N	1	5/01/86	5/01/86	29,451	METHOW R	METHOW R	MCOL	AD CLIP.	Y
						02	LA	7N	3	5/05/86	5/05/86	30,046	METHOW R	METHOW R	MCOL	AD CLIP.	Y	
						03	LD	7N	1	5/09/86	5/09/86	29,992	METHOW R	METHOW R	MCOL	AD CLIP.	Y	
												89,489	FROM 3 RELEASES					
		SU STEELHEAD	5/01/86	5/09/86	35,298	86226	01	RA	7P	1	5/01/86	5/01/86	11,780	BELOW PRD DAM	MID COLUMBIA R	MCOL	AD CLIP.	Y
						02	RA	7P	3	5/05/86	5/05/86	11,575	BELOW PRD DAM	MID COLUMBIA R	MCOL	AD CLIP.	Y	
						03	RD	7P	1	5/09/86	5/09/86	11,943	BELOW PRD DAM	MID COLUMBIA R	MCOL	AD CLIP.	Y	
												35,298	FROM 3 RELEASES					
		SU STEELHEAD	5/05/86	5/15/86	1,758	86234	04	RA	P7	1	5/05/86	5/05/86	216	METHOW R	METHOW R	MCOL	100% AD-UPPER CAUDAL CLIP ACTUALLY 7P WITH CAUDAL	Y
						01	LA	N7	1	5/09/86	5/09/86	557	METHOW R	METHOW R	MCOL	100% AD-UPPER CAUDAL CLIP ACTUALLY 7N WITH CAUDAL	Y	
						02	LA	N7	3	5/09/86	5/09/86	213	METHOW R	METHOW R	MCOL	100% AD-UPPER CAUDAL CLIP ACTUALLY 7N WITH CAUDAL	Y	
						05	RA	P7	3	5/09/86	5/09/86	456	METHOW R	METHOW R	MCOL	100% AD-UPPER CAUDAL CLIP ACTUALLY 7P WITH CAUDAL	Y	
						03	LD	N7	1	5/15/86	5/15/86	190	METHOW R	METHOW R	MCOL	100% AD-UPPER CAUDAL CLIP ACTUALLY 7N WITH CAUDAL	Y	
						06	RD	P7	1	5/15/86	5/15/86	126	METHOW R	METHOW R	MCOL	100% AD-UPPER CAUDAL CLIP ACTUALLY 7P WITH CAUDAL	Y	
												1,758	FROM 6 RELEASES					
												126,545	FROM 12 RELEASES					
												462,762	FROM 30 RELEASES					

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID #	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME	ZONE	COMMENTS.....	FPC BRAND	
YATR NON-HATCHERY	SP CHINOOK	8/23/85	11/05/85	4,201	86308	01	RA	+Y	1	8/23/85	10/28/85	140	NACHES R	NACHES R	MCOL	40 REL 8/23, 100 REL 10/28.	
						03	RA	+Y	3	8/23/85	10/27/85	122	NACHES R	NACHES R	MCOL	22 REL 8/23, 100 REL 10/27.	
						09	RA	7N	1	9/05/85	10/28/85	128	NACHES R	NACHES R	MCOL	28 REL 9/5, 100 REL 10/28.	
						11	LA	7N	1	9/13/85	10/16/85	168	NACHES R	NACHES R	MCOL	43 REL 9/13, 125 REL 10/16.	
						10	RA	7N	3	9/13/85	10/16/85	169	NACHES R	NACHES R	MCOL	116 REL 9/13, 53 REL 10/16.	
						15	LA	+P	1	10/09/85	10/09/85	103	NACHES R	NACHES R	MCOL		
						13	RA	+P	1	10/09/85	10/09/85	108	NACHES R	NACHES R	MCOL		
						14	RA	+P	3	10/09/85	10/09/85	94	NACHES R	NACHES R	MCOL		
						24	RA	00	1	10/09/85	10/09/85	37	NACHES R	NACHES R	MCOL		
						20	RA	W	1	10/16/85	10/16/85	90	NACHES R	NACHES R	MCOL		
						21	RA	W	3	10/16/85	10/16/85	105	NACHES R	NACHES R	MCOL		
						22	RA	W	4	10/16/85	10/16/85	24	NACHES R	NACHES R	MCOL		
						04	LA	+Y	1	10/27/85	10/27/85	152	NACHES R	NACHES R	MCOL		
						16	RA	+P	2	10/27/85	10/27/85	100	NACHES R	NACHES R	MCOL		
						17	RA	+P	4	10/27/85	10/27/85	98	NACHES R	NACHES R	MCOL		
						08	LP	+Y	1	10/28/85	10/28/85	210	NACHES R	NACHES R	MCOL		
						12	RP	7N	1	10/28/85	10/28/85	85	NACHES R	NACHES R	MCOL		
						19	LP	+P	1	11/01/85	11/01/85	150	NACHES R	NACHES R	MCOL		
						18	RP	+P	1	11/01/85	11/01/85	90	NACHES R	NACHES R	MCOL		
						06	RP	+Y	1	11/01/85	11/01/85	100	NACHES R	NACHES R	MCOL		
						07	RP	+Y	3	11/01/85	11/01/85	100	NACHES R	NACHES R	MCOL		
						05	LA	+Y	3	11/05/85	11/05/85	512	NACHES R	NACHES R	MCOL		
						23	LA	W	1	11/05/85	11/05/85	1,274	NACHES R	NACHES R	MCOL		
										LOT ID TOTAL.	4,159	FROM	23	RELEASES			
	SP CHINOOK	4/12/86	4/30/86	2,339	86301	03	LA	14	1	4/12/86	4/12/86	230	YAKIMA R	YAKIMA R	MCOL		
						01	RA	14	1	4/12/86	4/12/86	207	YAKIMA R	YAKIMA R	MCOL		
						02	RA	14	3	4/12/86	4/12/86	109	YAKIMA R	YAKIMA R	MCOL		
						06	LA	+N	1	4/15/86	4/15/86	118	YAKIMA R	YAKIMA R	MCOL		
						04	RA	+N	1	4/15/86	4/15/86	321	YAKIMA R	YAKIMA R	MCOL		
						05	RA	+N	3	4/15/86	4/15/86	96	YAKIMA R	YAKIMA R	MCOL		
						09	LA	13	1	4/18/86	4/18/86	113	YAKIMA R	YAKIMA R	MCOL		
						07	RA	13	1	4/18/86	4/18/86	194	YAKIMA R	YAKIMA R	MCOL		
						08	RA	13	3	4/18/86	4/18/86	112	YAKIMA R	YAKIMA R	MCOL		
						12	LA	+P	1	4/23/86	4/23/86	100	YAKIMA R	YAKIMA R	MCOL		
						10	RA	+P	1	4/23/86	4/23/86	209	YAKIMA R	YAKIMA R	MCOL		
						11	RA	+P	3	4/23/86	4/23/86	90	YAKIMA R	YAKIMA R	MCOL		
						15	LP	14	1	4/30/86	4/30/86	110	YAKIMA R	YAKIMA R	MCOL		
						13	RP	14	1	4/30/86	4/30/86	220	YAKIMA R	YAKIMA R	MCOL		
						14	RP	14	3	4/30/86	4/30/86	110	YAKIMA R	YAKIMA R	MCOL		
										LOT ID TOTAL.	2,339	FROM	15	RELEASES			

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ABCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME ZONE	COMMENTS.....	FPC BRAND
YATR NON-HATCHERY	SP CHINOOK	4/23/86	5/08/86	499	86305	02	LA	+1	3	4/23/86	4/23/86	59	YAKIMA R	YAKIMA R	MCOL	
						01	RA	+1	3	4/23/86	4/23/86	215	YAKIMA R	YAKIMA R	MCOL	
						05	LA	+L	1	5/08/86	5/08/86	50	YAKIMA R	YAKIMA R	MCOL	
						03	LP	+L	1	5/08/86	5/08/86	25	YAKIMA R	YAKIMA R	MCOL	
						04	RA	+L	1	5/08/86	5/08/86	150	YAKIMA R	YAKIMA R	MCOL	
						LOT ID TOTAL.										
											499	FROM	5	RELEASES		
	CHINOOK	5/03/86	5/19/86	1,886	86311	03	LP	+H	1	5/03/86	5/03/86	89	YAKIMA R	YAKIMA R	MCOL	
						01	RP	+H	1	5/03/86	5/03/86	223	YAKIMA R	YAKIMA R	MCOL	
						02	RP	+H	3	5/03/86	5/03/86	122	YAKIMA R	YAKIMA R	MCOL	
						06	LP	13	1	5/07/86	5/07/86	87	YAKIMA R	YAKIMA R	MCOL	
						04	RP	13	1	5/07/86	5/07/86	205	YAKIMA R	YAKIMA R	MCOL	
						05	RP	13	3	5/07/86	5/07/86	91	YAKIMA R	YAKIMA R	MCOL	
						09	LP	+P	1	5/10/86	5/10/86	75	YAKIMA R	YAKIMA R	MCOL	
						07	RP	+P	1	5/10/86	5/10/86	208	YAKIMA R	YAKIMA R	MCOL	
						08	RP	+P	3	5/10/86	5/10/86	75	YAKIMA R	YAKIMA R	MCOL	
						11	LA	14	3	5/15/86	5/15/86	131	YAKIMA R	YAKIMA R	MCOL	
						12	LP	14	3	5/15/86	5/15/86	68	YAKIMA R	YAKIMA R	MCOL	
						10	RP	14	3	5/15/86	5/15/86	205	YAKIMA R	YAKIMA R	MCOL	
						14	LA	+H	3	5/19/86	5/19/86	91	YAKIMA R	YAKIMA R	MCOL	
						15	LP	+H	3	5/19/86	5/19/86	93	YAKIMA R	YAKIMA R	MCOL	
						13	RP	+H	4	5/19/86	5/19/86	123	YAKIMA R	YAKIMA R	MCOL	
						LOT ID TOTAL.										
											1,886	FROM	15	RELEASES		
	CHINOOK	5/23/86	6/10/86	288	86312	05	LA	+P	3	5/27/86	5/27/86	78	YAKIMA R	YAKIMA R	MCOL	
						06	LP	+P	3	5/27/86	5/27/86	80	YAKIMA R	YAKIMA R	MCOL	
						04	RP	+P	4	5/27/86	5/27/86	130	YAKIMA R	YAKIMA R	MCOL	
						LOT ID TOTAL.										
											288	FROM	3	RELEASES		
	FA CHINOOK	6/16/86	6/16/86	2,901	86315	15	LA	+F	1	6/16/86	6/16/86	153	YAKIMA R	YAKIMA R	MCOL	
						19	LA	+F	3	6/16/86	6/16/86	140	YAKIMA R	YAKIMA R	MCOL	
						01	LA	+L	1	6/16/86	6/16/86	143	YAKIMA R	YAKIMA R	MCOL	
						05	LA	+L	3	6/16/86	6/16/86	121	YAKIMA R	YAKIMA R	MCOL	
						09	LA	+Y	1	6/16/86	6/16/86	142	YAKIMA R	YAKIMA R	MCOL	
						13	LA	+Y	3	6/16/86	6/16/86	70	YAKIMA R	YAKIMA R	MCOL	
						16	LP	+F	1	6/16/86	6/16/86	128	YAKIMA R	YAKIMA R	MCOL	
						20	LP	+F	3	6/16/86	6/16/86	155	YAKIMA R	YAKIMA R	MCOL	
						02	LP	+L	1	6/16/86	6/16/86	134	YAKIMA R	YAKIMA R	MCOL	
						06	LP	+L	3	6/16/86	6/16/86	129	YAKIMA R	YAKIMA R	MCOL	
						10	LP	+Y	1	6/16/86	6/16/86	136	YAKIMA R	YAKIMA R	MCOL	
						17	RA	+F	1	6/16/86	6/16/86	163	YAKIMA R	YAKIMA R	MCOL	
						21	RA	+F	3	6/16/86	6/16/86	131	YAKIMA R	YAKIMA R	MCOL	
						03	RA	+L	1	6/16/86	6/16/86	119	YAKIMA R	YAKIMA R	MCOL	
						07	RA	+L	3	6/16/86	6/16/86	142	YAKIMA R	YAKIMA R	MCOL	

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AGCY HATCHERY.....	SPECIES.....	MAJOR RELEASE START	MAJOR RELEASE STOP	TOTAL NUMBER RELEASED	LOT ID	#	LOC	BRND	ROT	BRAND RELEASE START	BRAND RELEASE STOP	BRAND NUMBER RELEASED	RELEASE SITE...	RIVER NAME	ZONE	COMMENTS.....	FPC BRAND
YATR NON-HATCHERY	FA CHINOOK	6/16/86	6/16/86	2,901	86315	11	RA	+Y	1	6/16/86	6/16/86	144	YAKIMA R	YAKIMA R	NCOL		
						14	RA	+Y	3	6/16/86	6/16/86	84	YAKIMA R	YAKIMA R	NCOL		
						18	RP	+F	1	6/16/86	6/16/86	151	YAKIMA R	YAKIMA R	NCOL		
						22	RP	+F	3	6/16/86	6/16/86	138	YAKIMA R	YAKIMA R	NCOL		
						04	RP	+L	1	6/16/86	6/16/86	136	YAKIMA R	YAKIMA R	NCOL		
						08	RP	+L	3	6/16/86	6/16/86	120	YAKIMA R	YAKIMA R	NCOL		
						12	RP	+Y	1	6/16/86	6/16/86	120	YAKIMA R	YAKIMA R	NCOL		
										LOT ID TOTAL.		2,901	FROM 22	RELEASES			*
	COHO	4/25/86	5/09/86	1,454	86306	03	LA	+1	3	4/25/86	4/25/86	270	YAKIMA R	YAKIMA R	NCOL		
						01	RA	+1	3	4/25/86	4/25/86	500	YAKIMA R	YAKIMA R	NCOL		
						02	RP	+1	3	4/25/86	4/25/86	184	YAKIMA R	YAKIMA R	NCOL		
						04	RA	+L	1	5/09/86	5/09/86	500	YAKIMA R	YAKIMA R	NCOL		
										LOT ID TOTAL.		1,454	FROM 4	RELEASES			*
										HATCHERY TOTAL.		13,526	FROM 87	RELEASES			**
										AGENCY TOTAL...		13,526	FROM 87	RELEASES			***

* L A S T P A G E *

APPENDIX II

RECAPTURE HISTORY OF FREEZE BRANDED FISH RELEASED IN THE SNAKE RIVER DRAINAGE, 1986

CHINOOK

BRAND	HATCHERY	-----RELEASE DATA-----			-----RECOVERY DATA-----									
		SITE	DATE	NUMBER	#	50% DATE	#	50% DATE	#	50% DATE	#	50% DATE	#	50% DATE
YEARLING CHINOOK														
RD-Y-1	SAWTOOTH	SAWTOOTH H.	17-Mar	35,851	49	14-Apr	226	23-Apr	7	04-May	66	02-May	7	08-May
LD-Y-3	RAPID RIVER	HELLS CANYON	26-Mar	44,754	269	03-Apr	981	16-Apr	70	23-Apr	284	28-Apr	117	02-May
RD-Y-3	MCCALL	S.F. SALMON R.	27-Mar	43,487	229	23-Apr	508	02-May	34	07-May	172	15-May	46	13-May
RA-J-2,4	LOOKINGGLASS	LOOKINGGLASS CR	02-Apr	39,937	113	05-Apr	637	16-Apr	42	29-Apr	253	02-May	52	04-May
RA-Y-2	DWORSHAK	DWORSHAK H.	02-Apr	40,675	N/A	N/A	479	21-Apr	104	04-May	372	11-May	93	12-May
LD-Y-1	RAPID RIVER	RAPID RIVER	05-Apr	44,692	239	10-Apr	1,073	19-Apr	102	27-Apr	294	04-May	128	06-May
RD-K-1	IN-RIVER	LEWISTON TRAP	02-Apr	2,793	N/A	N/A	57	15-Apr	4	-----	19	24-Apr	7	-----
RD-K-2	IN-RIVER	LEWISTON TRAP	06-Apr	1,596	N/A	N/A	63	23-Apr	4	-----	12	30-Apr	12	04-May
RD-K-3	IN-RIVER	LEWISTON TRAP	11-Apr	2,743	N/A	N/A	50	22-Apr	5	-----	24	02-May	10	05-May
RD-K-4	IN-RIVER	LEWISTON TRAP	16-Apr	1,392	N/A	N/A	12	-----	3	-----	16	05-May	8	08-May
RA-K-2	IN-RIVER	LEWISTON TRAP	27-Apr	2,421	N/A	N/A	25	06-May	2	-----	23	16-May	8	-----
RA-K-1	IN-RIVER	LEWISTON TRAP	28-Apr	4,100	N/A	N/A	37	03-May	7	-----	59	11-May	20	15-May
RA-K-3	IN-RIVER	LEWISTON TRAP	10-May	1,227	N/A	N/A	27	17-May	2	-----	14	23-May	2	-----
RA-A,F,PI,R*	DWORSHAK	L. GRANITE DAM	27-Mar	54,000	N/A	N/A	N/A	N/A	188	27-Apr	803	05-May	323	08-May
LA-A,F,PI,R*	DWORSHAK	L. GRANITE DAM	30-Mar	54,000	N/A	N/A	N/A	N/A	161	26-Apr	733	01-May	376	04-May
RD-A,F,PI,R*	DWORSHAK	L. GRANITE DAM	02-Apr	54,000	N/A	N/A	N/A	N/A	197	26-Apr	780	02-May	371	07-May
LA-P-1	IN-RIVER	BELOW L. GOOSE	10-Apr	5,000	N/A	N/A	N/A	N/A	75	15-Apr	142	22-Apr	112	29-Apr
LA-P-2	IN-RIVER	BELOW L. GOOSE	13-Apr	5,000	N/A	N/A	N/A	N/A	121	19-Apr	277	27-Apr	161	02-May
LA-P-3	IN-RIVER	BELOW L. GOOSE	16-Apr	5,104	N/A	N/A	N/A	N/A	45	22-Apr	149	28-Apr	84	03-May
LA-P-4	IN-RIVER	BELOW L. GOOSE	19-Apr	5,000	N/A	N/A	N/A	N/A	26	25-Apr	56	01-May	43	06-May
LA-W-1	IN-RIVER	BELOW L. GOOSE	22-Apr	5,000	N/A	N/A	N/A	N/A	54	26-Apr	217	03-May	120	07-May
LA-W-2	IN-RIVER	BELOW L. GOOSE	25-Apr	5,000	N/A	N/A	N/A	N/A	47	29-Apr	201	06-May	89	09-May
LA-W-3	IN-RIVER	BELOW L. GOOSE	30-Apr	5,000	N/A	N/A	N/A	N/A	70	03-May	203	10-May	68	14-May
LA-W-4	IN-RIVER	BELOW L. GOOSE	09-May	4,998	N/A	N/A	N/A	N/A	40	14-May	174	20-May	48	21-May
LA-L-1	IN-RIVER	BELOW L. GOOSE	22-May	4,933	N/A	N/A	N/A	N/A	32	24-May	148	29-May	25	30-May
RA-7K-1	LYONS FERRY	LYONS FERRY H.	02-Apr	40,168	N/A	N/A	N/A	N/A	227	16-Apr	1,229	27-Apr	608	01-May
SUBYEARLING CHINOOK														
RA-T-3	LYONS FERRY	LYONS FERRY H.	10-Jun	81,003	N/A	N/A	N/A	N/A	835	28-Jun	1369	26-Jun	109	24-Jul

denotes number sampled

dashes indicate insufficient data

* denotes positions 1, 2, and 3

RECAPTURE HISTORY OF FREEZE BRANDED FISH RELEASED IN THE SNAKE RIVER DRAINAGE, 1986

STEELHEAD

BRAND	HATCHERY	SITE	RELEASE DATA		RECOVERY DATA									
			DATE	NUMBER	#	50% DATE	#	50% DATE	#	50% DATE	#	50% DATE	#	50% DATE
LD-T-2	HAGERMAN	SAWTOOTH H.	09-Apr	52,300	11	-----	290	28-May	4	-----	18	04-Jun	2	-----
LD-T-4	HAGERMAN	E F SALMON R.	08-Apr	51,325	12	-----	122	28-May	4	-----	12	04-Jun	0	-----
LA,RA,-J-1,3	IRRIGON	WALLOWA H.	02-May	59,734	19	-----	301	29-May	59	03-Jun	35	04-Jun	10	31-May
RD-T-2	NIAGARA SPRING	HELLS CANYON	27-Apr	51,328	38	02-May	336	07-May	9	-----	9	21-May	1	-----
RA-IJ-1,3,4	LYONS FERRY	GRANDE RONDE R.	27-Apr	60,000	111	06-May	990	20-May	47	25-May	90	27-May	34	31-May
RD-T-4	DWORSHAK	DWORSHAK H.	07-May	35,025	N/A	N/A	581	17-May	24	21-May	40	26-May	31	25-May
RA-J-2,4	IRRIGON	LITTLE SHEEP CR	27-Apr	28,095	19	-----	134	30-May	18	03-Jun	17	07-Jun	10	05-Jun
LA-P-1	IN-RIVER	BELOW L. GOOSE	26-Apr	4,319	N/A	N/A	N/A	N/A	97	29-Apr	196	02-May	98	04-May
LA-P-2	IN-RIVER	BELOW L. GOOSE	29-Apr	4,176	N/A	N/A	N/A	N/A	175	02-May	253	07-May	84	09-May
LA-P-3	IN-RIVER	BELOW L. GOOSE	05-May	4,966	N/A	N/A	N/A	N/A	152	08-May	209	13-May	101	15-May
LA-P-4	IN-RIVER	BELOW L. GOOSE	10-May	4,150	N/A	N/A	N/A	N/A	124	13-May	181	19-May	64	21-May
LA-W-1	IN-RIVER	BELOW L. GOOSE	15-May	4,249	N/A	N/A	N/A	N/A	131	18-May	168	22-May	59	24-May
LA-W-2	IN-RIVER	BELOW L. GOOSE	20-May	4,250	N/A	N/A	N/A	N/A	90	23-May	147	26-May	40	29-May
LA-W-3	IN-RIVER	BELOW L. GOOSE	24-May	4,250	N/A	N/A	N/A	N/A	99	26-May	100	29-May	32	31-May
LA-W-4	IN-RIVER	BELOW L. GOOSE	27-May	1287	N/A	N/A	N/A	N/A	11	29-May	41	31-May	3	-----
RA-7F-1	LYONS FERRY	BELOW L. GOOSE	21-Apr	20,035	N/A	N/A	N/A	N/A	628	26-Apr	671	11-May	285	13-May
RA-7F-3	LYONS FERRY	BELOW L. GOOSE	25-Apr	20,063	N/A	N/A	N/A	N/A	584	30-Apr	624	15-May	250	16-May
RD-7F-1	LYONS FERRY	BELOW L. GOOSE	29-Apr	20,069	N/A	N/A	N/A	N/A	571	03-May	469	18-May	150	17-May
LA-IT-1,3	LYONS FERRY	TUCANNON H.	06-May	40,000	N/A	N/A	N/A	N/A	351	29-May	115	30-May	115	30-May
RA-1K-1,3	LYONS FERRY	TUCANNON H.	07-May	40,000	N/A	N/A	N/A	N/A	455	22-May	597	27-May	255	29-May
LA-1K-1,3	LYONS FERRY	LYONS FERRY	25-Apr	40,000	N/A	N/A	N/A	N/A	1295	02-May	919	18-May	303	21-May
LA-IJ-1,3,4	LYONS FERRY	LYONS FERRY	25-Apr	60,000	N/A	N/A	N/A	N/A	2357	01-May	1,905	14-May	867	16-May
LA-7U-1	LYONS FERRY	BELOW ICE HARB.	25-Apr	11,998	N/A	N/A	N/A	N/A	N/A	N/A	352	05-May	210	02-May
LA-7U-3	LYONS FERRY	BELOW ICE HARB.	27-Apr	12,034	N/A	N/A	N/A	N/A	N/A	N/A	409	05-May	213	07-May
LD-7U-1	LYONS FERRY	BELOW ICE HARB.	29-Apr	12,018	N/A	N/A	N/A	N/A	N/A	N/A	320	09-May	110	10-May

denotes number sampled

dashes indicate insufficient data

-APPENDIX III

APPENDIX III: DISTANCE IN RIVER MILES FROM RELEASE/RECAPTURE SITES
TO MOUTH OF COLUMBIA RIVER

<u>Site</u>	<u>River Miles</u> ^(1.) (To <u>Mouth</u> of Columbia)
Savtooth Hatchery	897.0
Stanley/Salmon River	890.0
EF Salmon River	855.4
SF Salmon River	716.3
Rapid River Hatchery	605.4
Hells Canyon Dam	571.3
Grande Ronde (Steelhead)	522.0
Dworshak Hatchery	504.9
Grande Ronde River (fall chinook)	493.0
Lower Granite Dam	431.8
Little Goose Dam	393.0
Tucannon River	386.5
Lyons Ferry Hatchery	383.4
Ice Harbor Dam	333.0
Winthrop Hatchery	574.0
Methow River	523.9
Wells Dam	515.6
Leavenworth Hatchery	496.6
Rock Island Dam	453.4
Naches River	451.5
Priest Rapids Dam	397.0
McNary Dam	292.0
John Day Dam	215.6

(1.) Mileages from "River Mile Index" series issued by the Hydrology and
Hydraulics Committee, Pacific Northwest River Basins Commission 1964-1976.